# West 2050
# Installation & Operating Instructions

gulton

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# W E S T  2 0 5 0

## MICROPROCESSOR-BASED PROGRAMMER CONTROLLER

## INSTALLATION AND OPERATING INSTRUCTIONS

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NOTE

Our policy is one of continued improvement, and consequently the information contained in this publication may differ in some respects from the instrument in question. Therefore this document does not constitute an offer or part of an offer for sale.

## SECTION 4 – RERANGING AND RECONFIGURING


1.0 GENERAL

2.0 INPUTS

3.0 OUTPUTS

4.0 ALARMS

5.0 THERMOCOUPLE BREAK PROTECTION

6.0 MAINS (LINE) VOLTAGE

7.0 EVENT OUTPUT

8.0 CPU LINK JUMPERS

9.0 INTERNAL (CPU) SWITCHES

## LIST OF CONTENTS

### SECTION 1 – INTRODUCTION


1.1 GENERAL PRODUCT DESCRIPTION

1.2 SPECIFICATION

1.3 PRODUCT CODES


### SECTION 2 – INSTALLATION


1.0 UNPACKING

2.0 MOUNTING

3.0 CONNECTINGS AND WIRING

3.1 MAINS (LINE) POWER SUPPLY

3.2 INPUTS

3.3 OUTPUTS

4.0 REMOVAL OF INSTRUMENT FROM CASE

5.0 INDUCTIVE LOADS, EXTERNAL CONTACTOR AND MAINS OPERATED SOLID STATE RELAYS AS LOADS


### SECTION 3 – OPERATING INSTUCTIONS


1.0 SWITCH ON

2.0 CONTROLLER AND PROGRAMMER SET-UP MODES

3.0 INTERNAL FEATURE SELECTION

4.0 TUNING OF CONTROLLER

5.0 VMD INSRUMENTS – SETTING UP

6.0 ALARMS – SETTING UP

7.0 OPTIONS

# SECTION 1

# INTRODUCTION

## 1.1 GENERAL PRODUCT DESCRIPTION

The WEST 2050 is a Programmer-Controller designed to control temperature or other process variables to a pre-determined profile. The profile, which can be easily programmed by the user, can range in complexity from simply one fixed setpoint up to four stages each comprising a ramp and a dwell (soak). A 'cycling' facility has been provided, so that the profile can be automatically repeated (up to 9998 times).

The 2050 is a microprocessor-based instrument, and this technology has been fully exploited to provide sophisticated features and outstanding performance, never previously available on a low-cost Programmer-Controller. Amongst the numerous features of this product are the following

- comprehensive displayed status information, including run-time scrolling messages (in English, French or German) describing current setpoint value/time remaining in segment/number of cycles completed.

- all variable parameters easily set up from the front panel, and can be reviewed at any time.

- electronic combination lock which can be used to lock all variable parameters, and so prevent unauthorised tampering.

- range change facility without recalibration.

- selectable Guaranteed Soak feature.

- many different input and output types and ranges.

- optional extras such as

  * RS422 serial communications interface

  * programmable event output

  * remote programme start.

- extremely easy to use.

The technical specification of the 2050 is detailed at the end of this Section.

### 1.1.1 Using the 2050

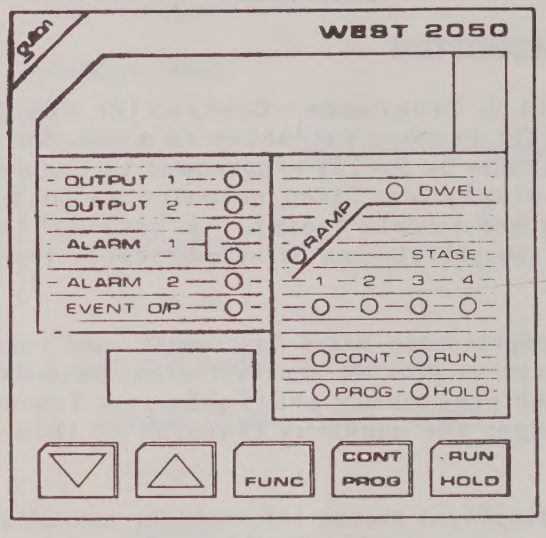



**FIGURE 1.1 WEST 2050 - FRONT PANEL**

Programming and operation of the 2050, is entirely controlled by the five pushbuttons on the instrument front panel. The following actions can be carried out from the front panel:-

- setting up of Controller parameters (P, I, D, initial setpoint etc.)
- setting up of Programmer parameters (ramp and dwell data, cycling etc.)
- running the programme (not if remote start option is fitted)
- holding the programme (not if remote start option is fitted)
- aborting (terminating) the programme
- skipping segments during programme run
- reviewing Controller and Programmer parameters (at any time including during programme run)
- selecting scrolling run-time messages.

Note that from the moment of switching on the 2050 it is acting as a process controller, and therefore operates to maintain the associated process variable (e.g. temperature) at the initial setpoint value. The primary difference when a programme is running, is that the setpoint value is changing according to the profile set up by the user.

When despatched from WEST, the 2050 has all variable parameters pre-programmed to a set of default values. As an example the setpoint value is set to "range minimum" so that for most applications no output power will be delivered at initial switch-on. In order to use the instrument in any particular application, it is necessary to alter the parameters (from the front panel) to the required values.

### 1.1.2 European and U.S.A. Nomenclature

There are a number of differences in the displayed information, between instruments being sold in Europe and the U.S.A. For example, the Initial Setpoint is represented by the abbreviation IW1 in Europe, and by ISP in the U.S.A. Throughout this manual these differences have been highlighted by printing the European symbols first, followed by the U.S.A. symbol in parentheses.

e.g. Initial Setpoint = IW1 (ISP).

## 1.2 SPECIFICATION

### INPUT

**Input types:** Thermocouple, RTD and DC linear
**Common mode rejection:** Negligible effect at up to 260V 50/60hz.
**Series mode rejection:** >1000% of span at 50/60Hz.
**Thermocouple break protection:** Upscale fitted as standard (downscale available as an option).
**Thermocouple calibration:** Complies with BS4937,NBS125 and IEC584 standards.
**RTD(Pt 100) calibration:** Complies with BS1904 and DIN43760

### OUTPUTS

**OUTPUT 1 (e.g. Heat)**
**Relay:**SPDT contact rating 5A resistive at 120/240V AC
**Relay life:**$10^6$ operations.
**Thyristor pulse:**Burst firing, time proportioned output, synchronised to zero voltage crossover points, 3.5V minimum at 200mA. Repetition rate 5KHz approximately.
**Valve motor drive:**Interlocked SPDT contacts rated 5A resistive at 240V AC (1A inductive). Slidewire range 100-2500 ohms.
**SSR drive:**0-5V DC into 40 ohms minimum (TTL Compatible)
**DC Linear:**0-20mA, $R_L$ <500 ohms.0-5V, 1-5V $R_S$=256 ohms.

**OUTPUT 2 (e.g. Cool)**

**Relay:**as output 1
**SSR drive:**as output 1

**AUXILIARY RELAYS (Alarms 1 and 2 and Event Output)**
**Relay:**SPDT contact rating 2A resistive at 120/240 V AC.
**Relay life:**$10^6$ operations.

### CONTROLLER

**Proportional Band:** 0.5-100.0% and ON/OFF
**Cycle Time:** O/P 1 Relay 2, 4, 8, 16, 32 or 64 seconds.
SSR drive and Thyristor pulse 1/4, 1/2, 1, 2, 4, 8 seconds.
O/P 2 2, 4, 8, 16, 32, 64 seconds.
**Integral time:** 1 second-99 minutes and 59 seconds and OFF.
**Derivative time:** 0-99 minutes and 59 seconds.
**Underlap/Overlap:** $\pm$20% of proportional band.
**Relative gain of output 2:** 0.02-1 and OFF (giving ON/OFF control).

## PROGRAMMER

**Number of stored programmes:** 1
**Stages per programme:** 4(each stage comprises one ramp plus one dwell).
**Ramp format:** Rate or time (internally selected).
**Ramp time:** 0-99 hours and 59 minutes (increments of 1 minute).
**Ramp rate:** 1-9999 units of temperature per hour.
**Dwell time:** as per ramp time
**Repeat cycles:** 1-9999 and continuous.
**Guaranteed soak time:** Internally selected ON/OFF.
**Power fail programme recovery:** Internally selected ON/OFF

## ENVIRONMENTAL

**Reference Conditions**
**Ambient temperature:**20°C ±2°C.
**Supply voltage:**120 or 240V ±1% 50/60Hz.
**Thermocouple resistance:** <10 ohms.
**RTD (Pt 100) resistance:** <0.1 ohm per lead.
(equal resistance in each lead).
**Operating conditions**
**Ambient temperature:**0-50°C operating -20 to +80°C storage
**Supply voltage:**193-260V, 50/60Hz or100-132V, 50/60Hz.
**Maximum thermocouple resistance:**<1000 ohms.
**Maximum RTD (Pt 100) resistance:** <5 ohms per lead (equal resistance in each lead).

## PERFORMANCE

**Measurement accuracy (under reference conditions):**
0.25% of span ±1 LSD.
**Temperature stability:**0.01% of span/°C change in ambient temperature.
**Cold junction compensation error:** .075°C/°C change in ambient temperature.
**Supply voltage influence on accuracy:**negligible effect within operating range.
**Thermocouple resistance influence on accuracy:**
100 ohms - <0.1% of span error.
1000 ohms - <0.5% of span error.
**RTD (Pt 100) resistance influence on accuracy:**5 ohms/ lead- <0.5% of span error.
**Programmer timebase accuracy:**0.005%.

## GENERAL

**Digital Display:**4 digits, 7 segment, decimal point and negative sign LED.
**Alphanumneric display:**4 character LED.
**Discrete displays:**16 LED indicators.
**Dimensions:**96 x 96 x 210mm.

**Weight:**2kg maximum.
**Front panel protection:**IEC 144 IP54.
**Power Consumption:**10VA maximum.
**Data retention:**Lithium battery 5 years typically.

## 1.3 PRODUCT CODES

The product codes define the "build" of the instrument under the following categories, each prefixed by a different letter.

| Category | Prefix |
|---|---|
| Model | M |
| Line voltage | L |
| Input | T |
| Output 1 | H |
| Output 2 | C |
| Options | X |

TABLE 1.1 PRODUCT CODE PREFIXES

The complete code that describes the instrument is the combination of all the product codes in the order shown below :

M L T H C X

The codes are shown in the following table :

| MODEL | CODE |
|---|---|
| European | M1050 |
| USA | M2050 |
| **LINE VOLTAGE** | **CODE** |
| 220 OR 240V nominal supply | L01 |
| 110 or 120V nominal supply | L02 |
| **INPUT** | **CODE** |
| **Thermocouple*** | |
| **R** 0-1650°C Pt 13%/Rh | T1127 |
| 32-3002°F Pt 13%/Rh | T1128 |
| **S** 0-1650°C Pt 10%/Rh | T1227 |
| 32-3002°F Pt 10%/Rh | T1228 |
| **B** 100-1820°C Pt 30%/Rh | T1983 |
| 212-3308°F Pt 30%/Rh | T1984 |
| **J** 0.0-205.0°C I/C | T1415 |

| | |
|---|---|
| 32.0-401.0°F I/C | T1416 |
| 0-450°C I/C | T1417 |
| 32-842°F I/C | T1418 |
| 0-760°C I/C | T1419 |
| 32-1400°F I/C | T1420 |
| **J (din)** 0.0-205.0°C I/C | T1815 |
| 32.0-401.0°C I/C | T1816 |
| 0-450°C I/C | T1817 |
| 32-842°F I/C | T1818 |
| 0-760°C I/C | T1819 |
| 32-1400°F I/C | T1820 |
| **T** -200 to +260°C Cu/Con | T1525 |
| -328 to +500°F Cu/Con | T1526 |
| **K** 0.0-205.0°C C/A | T1715 |
| 32.0-401.0°F C/A | T1716 |
| 0-600°C C/A | T1721 |
| 32-1112°F C/A | T1722 |
| 0-1371°C C/A | T1723 |
| 32-2500°F C/A | T1724 |

*Upscale thermocouple break protection is fitted as standard. If downscale break protection is required suffix the above code with 21, if no break protection is required suffix 22.

| INPUT | CODE |
|---|---|
| **3 wire RTD (Pt 100)** | |
| -101.0 to +100.0°C | T2230 |
| -150.0 to +212.0°F | T2231 |
| -200.0 to +205.0°C | T2232 |
| -328.0 to +401.0°F | T2233 |
| 0 to 600°C | T2221 |
| 32 to 1112°F | T2222 |
| **Linear *** | |
| 0-5mV | T4-10 |
| 0-10mV | T4-11 |
| 0-100mV | T4-12 |
| 0-20mA | T3-13 |
| 4-20mA | T3-14 |

*The second digit of this code should be chosen from the table below :

**Linear input display scale**

| | |
|---|---|
| 0.00-10.00 | -1-- |
| 0.00-14.00 | -2-- |
| 0.00-50.00 | -3-- |
| 0.0-100.0 | -4-- |
| 0.0-300.0 | -5-- |
| 0.0-700.0 | -6-- |

| | |
|---|---|
| 0-1000 | -7-- |
| 0-3000 | -8-- |

| **OUTPUT 1 (e.g. Heat)*** | **CODE** |
|---|---|
| Relay | H10 |
| DC Current 4-20mA | H21 |
| DC Current 0-2-mA | H24 |
| Thyristor Pulse** | H30 |
| Valve Motor Drive*** | H40 |
| SSR Drive | H50 |
| DC Voltage 1-5V (R source-256 ohms) | H61 |
| DC Voltage 0-5V (R source-256 ohms) | H64 |

*Output 1 is supplied as reverse acting. If direct acting output 1 is required suffix the above code with 31.

** Instruments fitted with thyristor pulse on output 1 (H30) are not available with output 2.

*** Instruments fitted with VMD output are not available with output 2, or with more than one alarm. This alarm is fitted as standard. The available alarm options are limited to :

| **VMD Alarm Option** | **CODE** |
|---|---|
| High Deviation - direct acting | C0042 |
| Low Deviation - direct acting | C0044 |
| Process Alarm - reverse acting | C0049 |
| Event Output - | C0057 |

NOTE: Unless otherwise specified the process alarm (49) will be supplied as the standard alarm.

| **OUTPUT 2 (e.g. Cool)*** | **CODE** |
|---|---|
| Not fitted | C00 |
| Relay | C10 |
| SSR Drive | C50 |

NOTE: Output 2 action is always the opposite of output1 action.
*A choice of alarms is available which may be selected by suffixing the above code with the options shown below:

| | |
|---|---|
| **Alarm 1** | |
| High deviation - direct acting | 42 |
| High deviation - reverse acting | 43 |
| Low deviation - direct acting | 44 |
| Low deviation - reverse acting | 45 |
| Limit comparator - relay energised within band | 46 |
| Band alarm - relay energises outside of band | 47 |
| **Alarm 2** | |
| Process alarm - direct acting | 48 |
| Process alarm - reverse acting | 49 |
| Event output - direct acting | 56 |
| Event output - reverse acting | 57 |
| NOTE: Event output and alarm 2 are mutually exclusive | |

| OPTIONS | CODE |
|---|---|
| RS422 serial communication | X02 |
| Sequencing digital input (remote start). | X10 |
| German alpha-numeric display | X15 |
| French alph-numeric display | X16 |

TABLE 1.2 PRODUCT CODES

# SECTION 2

# INSTALLATION

## 1.0 UNPACKING

Remove the equipment from its transit package and check for damage. Notify the carrier immediately in the case of damage, and notify West or their agent within three days of any damage or deficiences. The complete package should contain the instrument with two mounting bars and two screws.

## 2.0 MOUNTING

The instruments may be fixed onto any rigid panel of up to a quarter inch thickness (7mm). The dimensions of the required cut-out are shown in Figure 2.1. To ensure adequate cooling, the unit should be mounted with its face approximately vertical and with unrestricted air paths around it. It is recommended that for ease of operation the unit should be mounted at approximately eye level.

The procedure for mounting the instrument is as follows:

a) With the mounting screws and mounting bars removed, insert the instrument into the cut-out from the front.

b) Whilst supporting the instrument, place one of the mounting bars in position as shown in Figure 2.1 d).

c) Insert one of the screws as shown in Figure 2.1 c) and tighten slightly.

d) Insert the other mounting bar in a diagonally opposite position, insert the securing screw and tighten until the instrument is just secured.

e) Adjust the screws if necessary but do not over tighten.

If front panel protection to IEC 144 IP54 standard is required, consult West.

a)

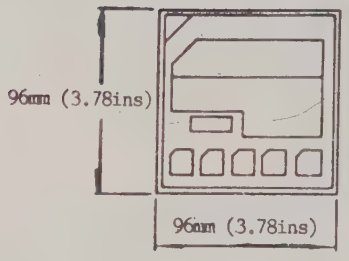
CUT-OUT OPENING

Each side is 92mm ($^{+0.8}_{-0}$ mm)

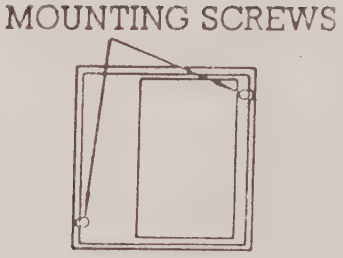
Each side is 3.62 inches ($^{+.03}_{-0}$ inches)

b)

FRONT PANEL




c)




d)

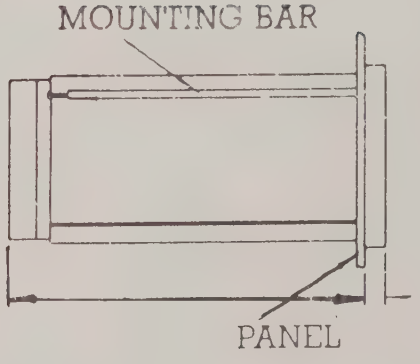



**FIGURE 2.1 MOUNTING DIMENSIONS**

## 3.0 CONNECTIONS AND WIRING

Note 1) Local requirements regarding electrical installation should be rigidly observed.

Ground terminals must be separately connected and not made common to the neutral.

Consideration should be given to the prevention of unauthorised personnel gaining access to power terminations. Figure 2.2 a, b, c) show the rear terminal connections for different instrument variants.

2) Event Output and Alarm 2 are mutually exclusive

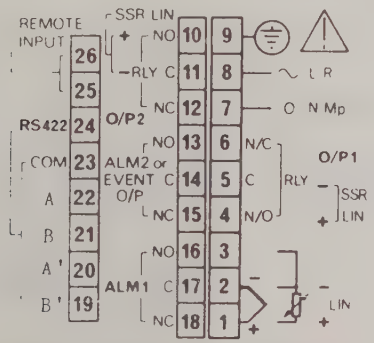



FIGURE 2.2 (a) REAR TERMINAL CONNECTIONS - STANDARD INSTRUMENTS

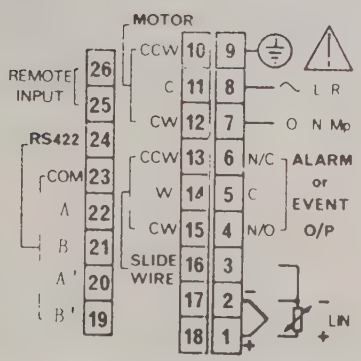



FIGURE 2.2 (b) REAR TERMINAL CONNECTIONS - VMD INSTRUMENTS

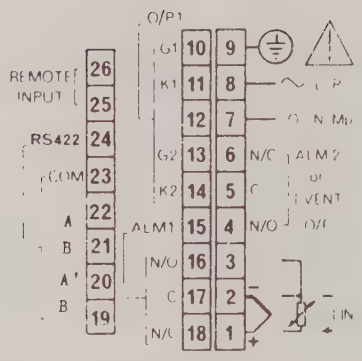



**FIGURE 2.2 c) REAR TERMINAL CONNECTIONS - THYRISTOR OUTPUT INSTRUMENTS**

## 3.1 Mains (Line) Power Supply

The mains supply voltage (line voltage) to the instrument is as follows :

193V-260V a.c. at 50 or 60 Hz - for instruments that include the product code L01.

100V-132V a.c. at 50 or 60 Hz - for instruments that include the product code L02.

Power consumption is 10VA maximum

The connections are shown in Figure 2.3

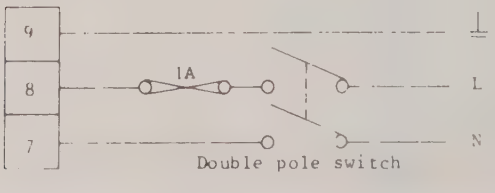



**FIGURE 2.3 POWER SUPPLY INPUT CONNECTIONS**

It is recommended that a 1 amp slow blow fuse and a double pole switch are included in the connections as shown in Figure 4. The earth (ground) terminal 9 should be connected to a protective earth (ground) conductor before any other wiring is made, and should remain connected at all times.

## 3.2 Signal inputs

The instrument will be configured to accept specific input types determined by the product code.
Connections for the following inputs are described in this section.

3.2.1 Thermocouple.
3.2.2 3-wire resistance thermometer.
3.2.3 Linear input.
3.2.4 Remote programme start.

### 3.2.1 Thermocouple

Thermocouple leads should be connected to terminal 1 (positive) and terminal 2 (negative). The correct type of thermocouple extension leadwire or compensating cable must be used for the entire distance between the instrument and thermocouple, ensuring that the correct polarity is observed throughout. Joints in the cable are not recommended. All instruments supplied with a thermocouple input have a cold junction compensation bobbin fitted across terminals 2 and 3. The bobbin should never be removed.

**NOTE. DO NOT RUN THERMOCOUPLE LEADS ADJACENT TO POWER CARRYING CONDUCTORS. IF THE WIRING IS RUN IN A CONDUIT, USE A SEPARATE CONDUIT FOR THE THERMOCOUPLE WIRING. IF THE THERMOCOUPLE IS EARTHED (GROUNDED), THIS SHOULD BE AT ONE POINT ONLY.**

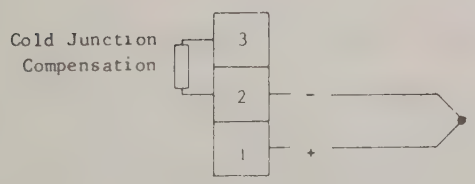



FIGURE 2.4 THERMOCOUPLE INPUT CONNECTORS

| THERMOCOUPLE MATERIAL | BRITISH BS | AMERICAN ASTM | GERMAN DIN | FRENCH NFE |
|---|---|---|---|---|
| T Copper<br>Constantan | + white<br>- blue<br>blue | + blue<br>- red<br>blue | + red<br>- brown<br>brown | + yellow<br>- blue<br>blue |
| J Iron/Constantan | + yellow<br>- blue<br>black | + white<br>- red<br>black | + red<br>- blue<br>blue | + yellow<br>- black<br>black |
| K Nickel Chromium<br>Nickel Aluminium | + brown<br>- blue<br>red | + yellow<br>- red<br>yellow | + red<br>- green<br>green | + yellow<br>- purple<br>yellow |
| R 13% Copper<br>S 10% Copper Nickel | + white<br>- blue<br>green | + black<br>- red<br>green | + red<br>- white<br>white | + yellow<br>- green<br>green |

TABLE 2.1 THERMOCOUPLE LEAD WIRE COLOUR CODES

### 3.2.2 3-Wire Resistance Thermometer (RTD)

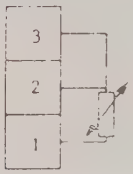



FIGURE 2.5. 3-WIRE RESISTANCE THERMOMETER

Connect resistance element to terminals 1 and 2.
Connect compensating lead to terminal 3.
Extension leads should be of copper.
The connecting leads should be of equal length and have a resistance < 5 ohms per lead.

### 3.2.3 Linear Input

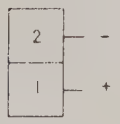



FIGURE 2.6 LINEAR INPUT CONNECTIONS

Connect positive lead to terminal 1.
Connect negative lead to terminal 2.
Use copper conductors for all connections.

**NOTE: DO NOT RUN LEADS ADJACENT TO POWER CARRYING CONDUCTORS. IF THE WIRING IS RUN IN A CONDUIT USE A SEPARATE CONDUIT FOR THE INPUT WIRING. IF THE INPUT WIRING IS EARTHED (GROUNDED), THIS SHOULD BE DONE AT ONE POINT ONLY.**

### 3.2.4 Remote Programme Start

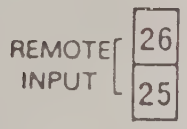



FIGURE 2.7 REMOTE PROGRAMME START INPUT

This option provides a Remote Programme Start facility. An external single pole switch or relay, with voltage free contacts, should be connected between terminals 25 and 26. (See Section 3 - 7.1.)

## 3.3 Outputs

### 3.3.1 Output 1

The output 1 will be one of the following according to the specification of the instrument.

a) Relay
b) SSR drive
c) Linear (Current voltage)
d) Valve Motor Drive (VMD)
e) Thyristor Pulse Output

a) Relay - O/P 1

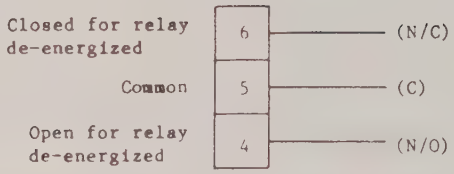



FIGURE 2.8 RELAY OUTPUT CONNECTIONS - O/P 1

The relay output contacts within the instrument are rated up to 5A at 240v a.c. for resistive loads. If other than purely resistive loads are used see section 5.0 at the end of this Section.

b) Solid State Relay (SSR) Drive

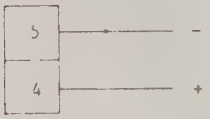



FIGURE 2.9 SOLID STATE RELAY (SSR) CONNECTIONS

Instruments with this output produce a non-isolated d.c. time proportioned signal for operating external solid state relays (which must have an isolated input).

c) Linear

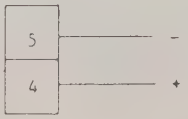



FIGURE 2.10 LINEAR OUTPUT CONNECTIONS

Instruments with this output produce an isolated d.c. current or voltage (for available ranges see the **Specification**).

**d) Valve Motor Drive**

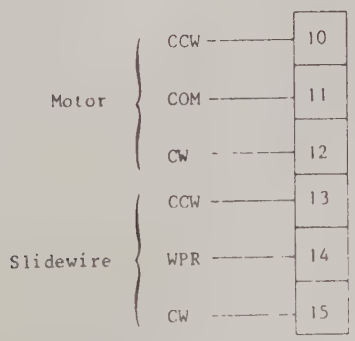



FIGURE 2.11 VALVE MOTOR DRIVE CONNECTIONS

Instruments with VMD output 1 have two SPDT relays with interlocked contacts. The relay contacts are rated at up to 5A at 240 V a.c. (resistive). Motor slidewire resistance of between 100 ohms and 2000 ohms can be accommodated.

**e)Thyristor Pulse Output**

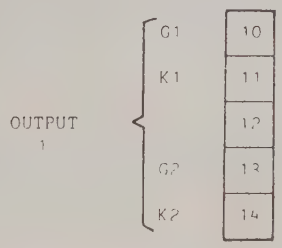



FIGURE 2.12 THYRISTOR PULSE OUTPUT CONNECTIONS -O/P 1

Instruments with this output produce isolated pulse trains of time proportioned bursts of an integral number of supply cycles synchronised to the zero voltage crossover points. Output is either for two thyristors connected in an inverse parallel configuration or for triac.

### 3.3.2 Output 2

If the instrument is supplied with an Output 2, the output will include one of the following types and any of the specified alarms (See **3.3.3 Alarms** in this Section for details of alarms).

**a)** Relay
**b)** Solid State Relay (SSR)

Output 2 is not available on instruments with VMD or Thyristor Pulse Output.

**a) Relay - O/P2**

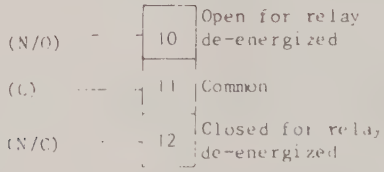



**FIGURE 2.13 RELAY OUTPUT CONNECTIONS - O/P 2**

**The relay output contacts within the instrument are rated up to 5A at 240v a.c. for resistive loads. If other than purely resistive loads are used see section 5.0 at the end of this Section.**

**b) Solid State Relay Drive - O/P2**

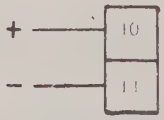



**FIGURE 2.14 SOLID STATE RELAY DRIVE CONNECTIONS - O/P 2**

Instruments with this output produce a non-isolated d.c. time proportioned signal for operating external solid state relays (which must have an isolated input).

### 3.3.3 Alarms

On instruments other than those referred to in the following Notes 1) and 2), there are two categories of alarm outputs. The categories are referred to as **Alarm 1** and **Alarm 2.**

Notes: 1) Instruments with VMD output do not have more than one type of alarm ( see **Alarm - VMD** )
2) Instruments with the Event Output do not have any alarm as described under **Alarm 2.**

**a) Alarm 1** (not applicable to instruments fitted with VMD Output 1)

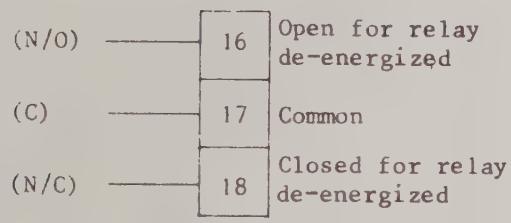



FIGURE 2.15 ALARM 1 CONNECTIONS

The following types of Alarm 1 are available.

| | |
|---|---|
| High deviation | - Direct acting |
| High deviation | - Reverse acting |
| Low deviation | - Direct acting |
| Low deviation | - Reverse acting |
| Limit comparator | - Energised within band |
| Band alarm | - Energised outside of band |

**b) Alarm 2** (Not applicable to instruments with Thyristor Output 1 or to instruments with Event Output.

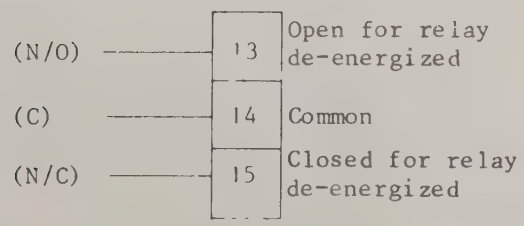



FIGURE 2.16 ALARM 2 CONNECTIONS

The following types of Alarm 2 are available

Process Alarm - Direct Acting
Process Alarm - Reverse Acting

**c) Alarm - VMD** (Applicable to instruments with VMD Output 1 and without event output only)

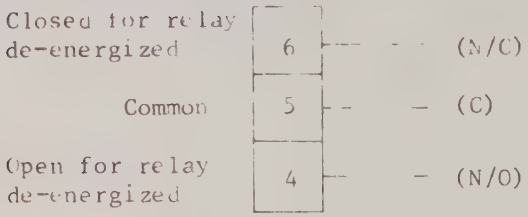



**FIGURE 2.17 ALARM CONNECTIONS - VMD INSTUMENTS**

The following types of alarm are available

High Deviation - Direct acting
Low Deviation - Direct acting
Process Alarm - Reverse acting

**d) Alarm 2 - Thyristor** (Applicable to instruments with Thyristor Output 1 and without Event Output only)

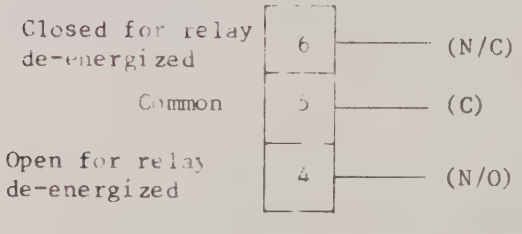



**FIGURE 2.18 ALARM 2 CONNECTIONS - THYRISTOR OUTPUT INSTRUMENTS**

The following types of Alarm 2 are available.

Process Alarm - Direct acting
Process Alarm - Reverse acting

### 3.3.4 Event Output

NOTE: INSTRUMENTS WITH EVENT OUTPUT HAVE NO ALARM 2

This output relay can be programmed from the front panel to be on or off for each ramp and dwell.
The output is of the relay contact form. The contacts are rated at 2A (resistive load) at 240V maximum (see **5.0 Inductive Loads, External Contactor Mains Operated Solid State Relays as Loads** in this Section).

**a) Event Output** –(Not applicable to instruments with VMD or Thyristor Output 1)

FIGURE 2.19 EVENT OUTPUT RELAY CONNECTIONS

**b) Event Output** – (applicable to instruments with VMD or Thyristor Output 1 only)

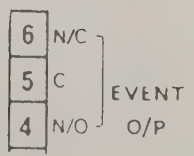



FIGURE 2.20 EVENT OUTPUT RELAY CONNECTIONS - VMD AND THYRISTOR INSTRUMENTS

### 3.3.5 RS422 Communications

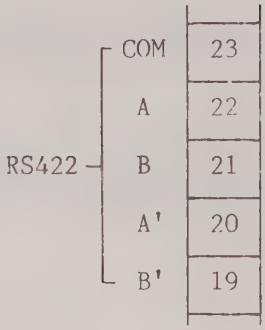



**FIGURE 2.21 RS422 COMMUNICATIONS CONNECTIONS**

For operating details consult WEST.

## 4.0 REMOVAL OF INSTRUMENT FROM CASE

WARNING: BEFORE REMOVING THE INSTRUMENT FROM ITS CASE THE INSTRUMENT MUST BE DISCONNECTED FROM THE MAINS (LINE) SUPPLY.

Insert a small screwdriver into the slot below the RUN/HOLD pushbutton and put a small downward pressure on the handle of the screwdriver so that the small latch inside the slot is raised. Pull out the hinged retaining lever just to the left of the slot so that the instrument is levered out from the rear connections. Pull on the instrument squarely to withdraw the instrument from its case.

## 5.0 INDUCTIVE LOADS, EXTERNAL CONTACTOR AND MAINS OPERATED SOLID STATE RELAYS AS LOADS

WARNING: OPERATING THE INSTRUMENT WITH INDUCTIVE LOADS AND WITHOUT THE APPROPRIATE PROTECTION NETWORK MAY GIVE RISE TO A HAZARD DUE TO HIGH VOLTAGE TRANSIENTS WHICH MAY OCCUR DURING THE SWITCHING CYCLES.

### 5.1 General

The 2050 instruments contain an internal protection (snubber) network which provides adequate protection for resistive loads and inductive loads up to 40mA.

**5.1.1** Higher inductive loads can cause the problems as stated below if recommended procedures as outlined in this document are not followed.

1) Damage to the contacts of the internal relay(s) of the instrument.

2) High voltage transients that can damage the PCB tracks with the possibility of a serious hazard.

3) Radio frequency interference (RFI) which can affect the performance of the instrument.

**5.1.2** External contactors used as loads can (under exceptional circumstances) cause problems by failing to release. This can occur to a contactor which is of the very low current type, so that the current through internal protection network capacitors is greater than the release current.

**5.1.3** Mains operated solid state relays can cause problems by "holding on" due to the current through the internal protection network capacitors not allowing the input voltage to fall sufficiently to turn the device off.

**5.1.4** The recommendations for the above situations are given for the following load applications:

a) Inductive loads

i) Applications up to 40mA

ii) Applications greater than 40mA

b) Very low current external contactors

c) Mains operated solid state relays

## 5.2 Inductive Loads

### 5.2.1 Applications up to 40mA

The snubber network already fitted in the instrument provides adequate protection for inductive load applications up to 40mA.

### 5.2.2 Applications greater than 40mA

Additional external protection components are required for inductive load applications greater than 40mA. For SPDT relay contacts these components are two capacitors and a resistor and are fitted in parallel (preferably) with the load(s), or across the instrument output, as shown in Figure 1. For SPST relay contacts (or if only one contact of an SPDT relay is used) the connections for the required capacitor and a resistor are as shown in Figure 2.22.

The required values for the components used for up to 240V r.m.s. applications are as shown in the following Table 2.2.

| LOAD CURRENT | VALUE OF C uF | VALUE OF R ohms |
|---|---|---|
| <70mA | 0.047 | 22 |
| <150mA | 0.1 | 47 |
| <0.5A | 0.22 | 47 |
| <1A | 0.47 | 47 |

NOTE: ALL CAPACITORS SHOULD CONFORM TO VDE (CLASS X) AND BE SUITABLE FOR OPERATION AT 260V A.C.

ALL RESISTORS (WIREWOUND OR ALLAN BRADLEY TYPE HB) SHOULD HAVE A MINIMUM RATING OF 2 WATTS

TABLE 2.2 VALUES OF PROTECTION NETWORK COMPONENTS

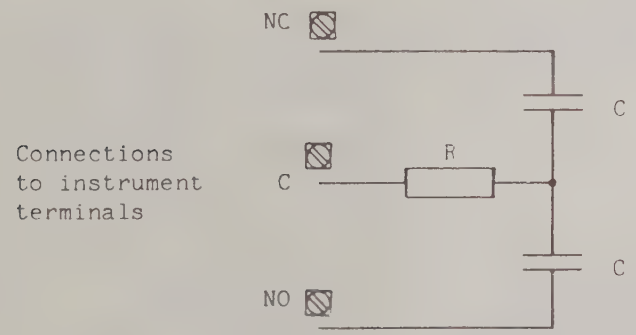



FIGURE 2.22 CONNECTION OF EXTERNAL PROTECTION COMPONENTS FOR SPDT RELAY CONTACTS

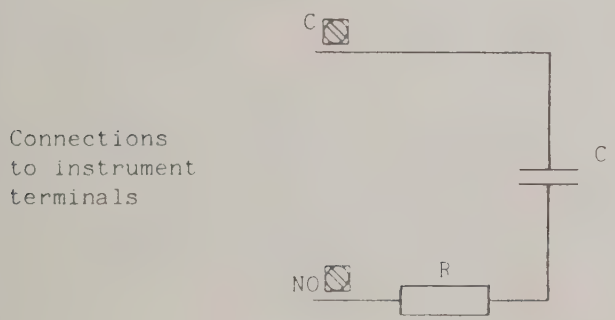



FIGURE 2.23 CONNECTION OF EXTERNAL PROTECTION COMPONENTS FOR SPST RELAY CONTACTS

### 5.2.3 External Switch in Series with an External Inductive Load

Damage to the instrument may result if the contacts of an unprotected switch, relay or contactor are connected externally in series with the instrument relay contacts as shown in Figure 2.24.

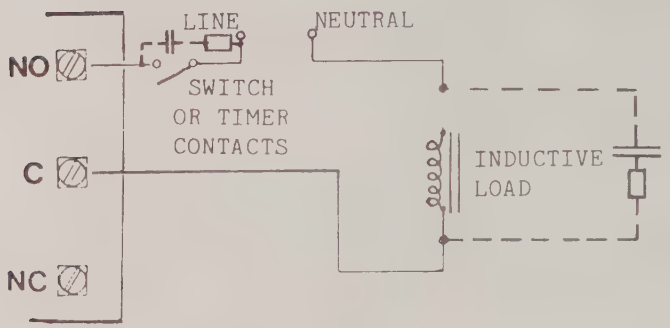



**FIGURE 2.24 EXTERNAL SWITCH IN SERIES WITH AN EXTERNAL INDUCTIVE LOAD**

Under these conditions the external contacts may operate while the instrument relay contacts are closed (i.e. the internal protection components short circuited and therefore ineffective).

In applications where it is necessary to fit external switch, relay or contactor contacts in series with the instrument relay a snubber network must be fitted either across the inductive load or across the unprotected contacts. The values given in Table 2.1 may be used.

### 5.2.4 Very low current contactor

In exceptional cases where the contactor requires a very low nominal energising current ( 20mA at 240V) it is possible that the current through the snubber network capacitor(s) (when the relay contacts are open) will be sufficient to continue to energise the contactor.

A solution to the problem is to fit a

resistor in parallel with the contactor coil. Normal contactor operation can be restored by fitting an 18K ohm resistor of at least a 4 Watt rating, across the contactor coil.

NOTE: Connecting alarm outputs in parallel increases the current which increases the possibility of an external contactor not releasing.

### 5.3 Mains Operated State Relays

The use of mains operated solid state relays driven from the relay output of the instrument is not recommended.

The current through the instrument's internal snubber network capacitors may allow the input voltage of the SSR to remain above the minimum release voltage. This prevents any control of the power output.

A resistor across the SSR is NOT a solution due to the excessive power dissipation.

WARNING: REMOVAL OF THE INSTRUMENT'S INTERNAL SNUBBER COMPONENTS COULD GIVE RISE TO A SERIOUS HAZARD. GULTON LIMITED AND GULTON INDUSTRIES INC. DO NOT ACCEPT RESPONSIBILITY FOR ANY DAMAGE WHICH MAY RESULT AS A RESULT OF THE UNAUTHORISED REMOVAL OF THESE COMPONENTS.

# SECTION 3 OPERATING INSTRUCTIONS

## 1.0 SWITCH-ON

Upon switching on the a.c. mains (line) supply, the instrument carries out a self-test procedure as described below.

### 1.1 Self-Test Procedure

The internal microprocessor checks the integrity of the RAM and EPROM memories and certain other hardware functions. During this procedure the front panel displays assume the following status:

a) |TEST| appears in the alphanumeric (lower) display

b) |-8.8.8.8.| appears in the numeric display

c) All ten front panel LEDs in the orange area are illuminated

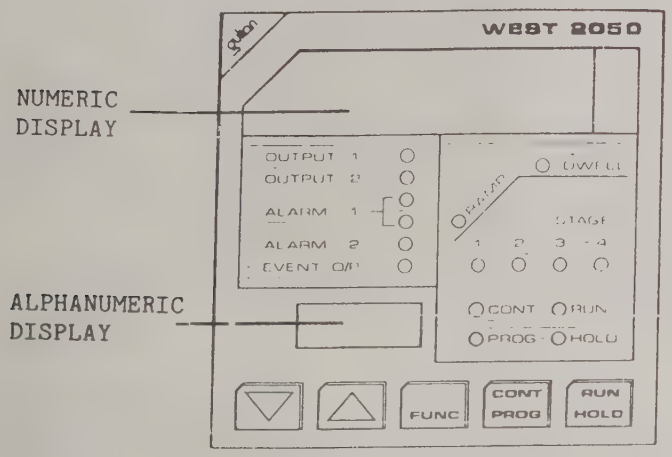



FIGURE 3-1 ALPHANUMERIC AND NUMERIC DISPLAY

When the self-test procedure has been satisfactorily completed

a) The value of the process variable is shown on the numeric display, and one or more LEDs in the blue area may be illuminated

b) All the LEDs in the orange area are extinguished

c) The alphanumeric display becomes blank

At this point momentarily pressing the control marked FUNC causes a 'scrolling message' of the set-point value to be shown on the alphanumeric display. The scrolling message can be removed by pressing FUNC a second time.

## 2.0 CONTROLLER AND PROGRAMMER SET-UP MODES

From the mmoment of switch-on the 2050 is operating as a temperature (or process) controller, using the parameters already present in its memory. In addition, if the RUN LED is illuminated (the RUN pushbutton having been pressed) the the instrument will be following the profile which is also stored in its memory. **If the instrument has inadvertantly been put into RUN mode it can be taken out by pressing the RUN/HOLD pushbutton and keeping it pressed for several seconds until ABRT appears in the alphanumeric display. (See section 2.2.12)**

When dispatched from WEST the 2050 has all variable parameters set to default values. For instance the Set-point value is set to range minimum so that for most applications no output power will be delivered at initial switch-on. In order to use the instrument in any particular application it is necessary to alter the parameters (from the front panel) to the the value required. To alter (or review) Controller parameters, the front panel must first be set to the 'Controller Set-up' Mode. Similarly to alter (or review) Programmer parameters, the front panel must be set to 'Programmer Set-up' Mode.

Selection of the front panel set-up mode is by use of the CONT/PROG pushbutton.

| | |
|---|---|
| Momentarily depress CONT/PROG | - the instrument goes into the controller setup mode, indicated on the front panel by the illumination of the CONT LED |
| Momentarily depress CONT/PROG again | - the instrument goes into the programmer set-up mode, indicated on the front panel by the illumination of the PROG LED. |

This control is of the alternated action type so that repeated operation will alternately select the controller and then the programmer set-up modes.

## 2.1 Controller Set-up Mode

### 2.1.1 Controls

FIGURE 3-2 PUSHBUTTONS FOR CONTROLLER SET-UP MODE

**Controller/programmer set-up mode select**

This selects controller or programmer set-up mode as described previously.

**Function (parameter) select**

In controller set-up mode momentary operation of this pushbutton will select a controller parameter. If the pushbutton is held down, each parameter is automatically selected in sequence. The name of the parameter appears in the alphanumeric display with the value in the numeric display.

**Parameter Raise**

This pushbutton is used to raise tha value of a selected parameter. The value of the selected parameter is shown on the numeric display. Momentary operation of the pushbutton causes the value to be changed by one least significant digit. If the button is held down the value is changed at 25 units per second after one second, and 250 units per second after 8 seconds.

**Parameter Lower**

This pushbutton is used to lower tha value of a selected parameter. The value of the selected parameter is shown on the numeric display. Momentary operation of the pushbutton causes the value to be changed by one least significant digit. If the button is held down the value is changed at 25 units per second after one second, and 250 units per second after 8 seconds.

## 2.1.2 Controller Parameters

The following parameters can always be selected in controller set-up mode, by repeated operation of the FUNC pushbutton.

| PARAMETER | ALPHANUMERIC DISPLAY INDICATION | | IS THE PARAMETER LOCKABLE? |
|---|---|---|---|
| | EUROPE | USA | |
| Setpoint | IW1 | ISP | No |
| Power Output * | Y% | PWR% | N/A |
| Security Code ** | LOCK/CODE | LOCK/CODE | No |
| Proportional Band | XP% | PB% | Yes |
| Integral Term | TN | RST | Yes |
| Derivative Term | TV | RATE | Yes |
| Set-point Limit | WMAX | SPMX | Yes |
| Power Limit | YMAX | PMX% | Yes |
| Heat Cycle Time | TYH | CTH | Yes |

TABLE 3-1 CONTROLLER PARAMETERS

* The power output is a 'display only' parameter, and therefore cannot be set by the operator.

** The security facility is selected ON or OFF by an internal switch. (For further details see section 3.1 SWITCH 1 - LOCK)

The following controller parameters are optionally available on the 2050. If a parameter is not provided it will be skipped during the selection of parameters when using the FUNC pushbutton.

| PARAMETER | ALPHANUMERIC DISPLAY INDICATION | | IS THE PARAMETER LOCKABLE? |
|---|---|---|---|
| | EUROPE | USA | |
| Deviation Alarm Value | ALM1 | ALM1 | Yes |
| Process Alarm Value | ALM2 | ALM2 | Yes |
| Cool Cycle Time | TYK | CTC | Yes |
| Relative Cooling Gain | XP2 | RCG | Yes |
| Overlap/Deadband | XSH | OVL% | Yes |

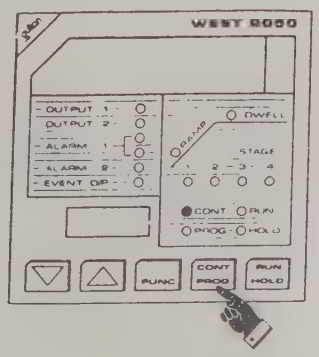
TABLE 3-2 OPTIONAL CONTROLLER PARAMETERS

After the last controller parameter has been selected, pressing the FUNC pushbutton once more causes the CONT LED to be extinguished, and the numeric display to revert to the Process Variable value.

## 2.1.3 Setting up controller parameters

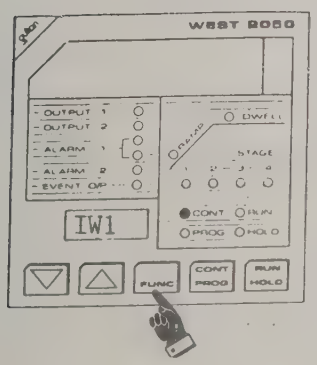
All displayed parameters can be altered by the operator except the 'display only' output parameter Y%(PWR%) - provided the instrument is not "locked" by the security facility (see Section 3.1).

a) Make sure the instrument is in the CONTROLLER mode (i.e. CONT/PROG has been pressed and the CONT LED is illuminated). Also make sure the instrument is not in RUN or HOLD mode (Press RUN/HOLD pushbutton and hold it it for several seconds to ABORT program operation)




b) Each parameter is selected using the FUNC pushbutton.

c) The value of the parameter is adjusted using the RAISE and LOWER pushbuttons.



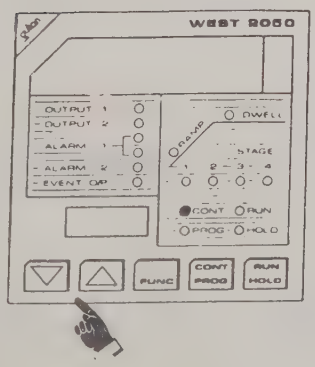




FIGURE 3-3 SETTING UP CONTROLLER PARAMETERS

The complete sequence of actions required to set up all controller parameters (except options) is summarised below:-

| ACTION | ALPHANUMERIC DISPLAY | | NUMERIC DISPLAY (value) | TO SET PARAMETER USE | RANGE AND NOTES |
|---|---|---|---|---|---|
| | EUROPE | USA | | | |
| Press CONT PROG (CONT LED ON) | IW1 | ISP | Setpoint | △ or ▽ | Can be set up between range minimum and setpoint limit WMAX (SPMX) |
| Momentarily press FUNC | Y% | PWR% | Power output % | Not applicable | 0 to 100% for instruments with output 1 only. -100% to +100% for instruments with output 1 and 2. Display only. |
| Momentarily press FUNC again | LOCK/ CODE | LOCK/ CODE | See under '3.1 LOCK' later | △ or ▽ | 0 to 9999. Internal switch used in conjunction with displayed code |
| Momentarily press FUNC again | XP% | PB% | Proportional band % | △ or ▽ | 0% (on/off control) 0.5% to 9.9% increments of 0.1%.. 10.0% to 100.0% increments of 1%. |
| Momentarily press FUNC again | TN | RST | Integral term | △ or ▽ | 1 sec to 99 mins. 59 secs. Parameter skipped if PB% set to zero. If an attempt is made to set >99.59 the display goes blank and integral is off. |
| Momentarily press FUNC again | TV | RATE | Derivative term | △ or ▽ | 0 sec to 99 mins. 59 secs. Parameter skipped if PB% set to zero. |
| Momentarily press FUNC again | WMAX | SPMX | Setpoint limit | △ or ▽ | Can only be set between highest setpoint value and range maximum. |

continued on next page

| ACTION | ALPHANUMERIC DISPLAY EUROPE | ALPHANUMERIC DISPLAY USA | NUMERIC DISPLAY (value) | TO SET PARAMETER USE | RANGE AND NOTES |
|---|---|---|---|---|---|
| Momentarily press [FUNC] again | YMAX | PMX% | Power limit (%) | [Δ] or [∇] | 0% to 100%. Parameter skipped if PB% set to zero. |
| Momentarily press [FUNC] again | TYH | CTH | 'Heat' cycle time | [Δ] or [∇] | Times of 2,4,8,16, 32 and 64 secs. or optionally .25, .5, 1,2,4,8 secs. Parameter skipped if PB% (XP%) = zero. |

TABLE 3.3 SETTING UP CONTROLLER PARAMETERS

Note. Any attempt to raise or lower a parameter outside of its allowable range, will not be successful and will cause the numeric display and the CONT LED to flash. Similarly, the display will flash if the raise or lower pushbuttons are pressed while output power Y% (PWR%) is being displayed.

If the instrument includes any options, then any (or all) of the following additional parameters may be available. If available, these parameters can be set up as summarised below. The parameter display of options which are not included or enabled will be skipped.

| ACTION | ALPHANUMERIC DISPLAY EUROPE | ALPHANUMERIC DISPLAY USA | NUMERIC DISPLAY (value) | TO SET PARAMETER USE | RANGE AND NOTES |
|---|---|---|---|---|---|
| Momentarily press [FUNC] again | ALM1 | ALM1 | Deviation alarm value | [Δ] or [∇] | Zero to span of instrument. |
| Momentarily press [FUNC] again | ALM2 | ALM2 | Process alarm value | [Δ] or [∇] | Range minimum to range maximum |
| Momentarily press [FUNC] again | TYK | CTC | 'Cool' cycle time | [Δ] or [∇] | Times of 2,4,8,16, 32, 64 secs. Parameter skipped if PB% (XP%) = 0. |

continued on next page

| ACTION | ALPHANUMERIC DISPLAY | | NUMERIC DISPLAY (value) | TO SET PARAMETER USE | RANGE AND NOTES |
|---|---|---|---|---|---|
| | EUROPE | USA | | | |
| Momentarily press FUNC again | XP2 | RCG | Relative cooling gain | △ or ▽ | 0.02 to 1.00. If set to >1 output 2 goes to ON/OFF control. Parameter skipped if PB% (XP%) = 0. |
| Momentarily press FUNC again | XSH% | OVL% | Deadband /overlap | △ or ▽ | -20% to +20% of proportional band. Parameter skipped if PB% (XP%) = 0 |
| Momentarily press FUNC again | BLANK | BLANK | Process variable (normal display mode) | Not applicable | Setting up of controller parameters completed. |

TABLE 3.4 SETTING UP OPTIONAL CONTROLLER PARAMETERS

### 2.1.4 Default Values

When the instrument leaves the factory, the controller parameters are set to the default values shown in Table 3.5.

| PARAMETER | | DEFAULT VALUE | |
|---|---|---|---|
| EUROPE | USA | | |
| IW1 | ISP | RANGE MINIMUM | |
| Y% | PWR% | Not applicable | |
| LOCK | LOCK | LOCK VALUE 9999<br>CODE VALUE 0 | |
| XP% | PB% | 10.0% | |
| TN | RST | 5 MINUTES | |
| TV | RATE | 30 SECONDS | |
| WMAX | SPMX | RANGE MAXIMUM | |
| YMAX | PMX% | 100% | |
| ALM1 | ALM1 | 5 UNITS | * |
| ALM2 | ALM2 | RANGE MAXIMUM | * |
| TYH | CTH | 32 SECONDS.<br>4 SECONDS IF SSR<br>OR THYRISTOR O/P | |
| TYK | CTC | 32 SECONDS | * |
| XP2 | RCG | 1.00 | * |
| XSH% | OVL% | 0 | * |

TABLE 3.5 CONTROLLER PARAMETERS - DEFAULT VALUES

The 2050 employs extremely sophisticated techniques to prevent data corruption even in environments subject to the most severe electrical noise pollution. However, as a final precaution, if any programmable parameter is corrupted and cannot be restored from internal duplicate databases, then all programmable parameters will be reset to the default values.

*If appropriate option is included.

### 2.1.5 Output Status Indicators

These are the discrete LEDs in the blue area.

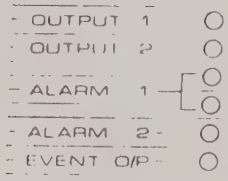
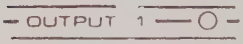
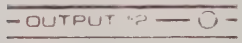


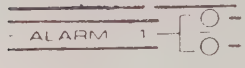

FIGURE 3.4 OUTPUT STATUS INDICATORS




This LED is on when power is being supplied to output 1 (only applicable to instruments with Relay or SSR output).




This LED is on when power is being supplied to output 2. Non-functional if output 2 is not fitted.

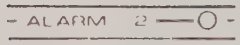



This is either a deviation alarm (direct or reverse acting) or a band alarm/limit comparator.

The red LED is illuminated when there is an alarm condition.

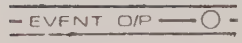
The green LED is illuminated in the safe condition.

Non functional if alarm 1 is not included.




This is a process alarm (direct or reverse acting). The red LED is illuminated when there is an alarm condition.

Non functional if alarm 2 is not included.




This LED is on when the programmer event output is on.

Non functional if the event output option is not included.

Note. Alarm 2 and Event O/P are mutually exclusive, and therefore cannot be provided in the same instrument.

## 2.2 Programmer Set-Up Mode

The 2050 can be programmed to carry out a 1,2,3 or 4 stage profile, where each stage comprises one Ramp and one Dwell (Soak). If less than 4 stages are required, the unwanted stages are eliminated by programming them with null values. Figure 3.5 illustrates a possible 3 stage profile. Note that until the profile is commenced (by pressing the RUN pushbutton) the 2050 will control to initial setpoint IW1 (ISP). Similarly at the end of the profile, the setpoint will immediately return to IW1 (ISP).

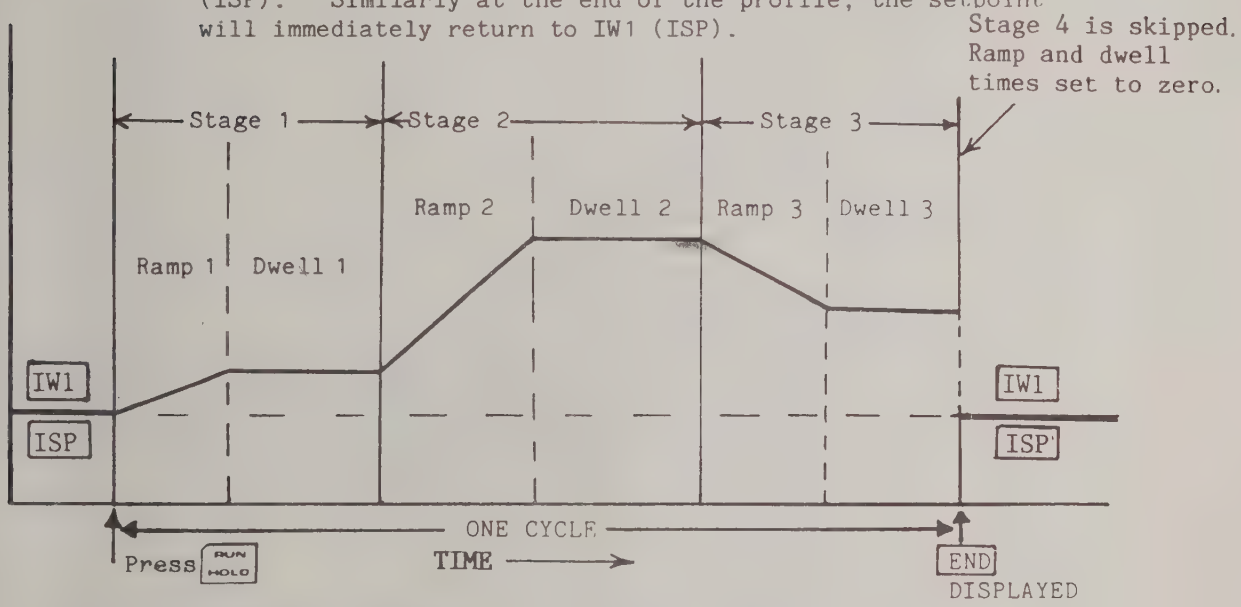



FIGURE 3.5 EXAMPLE OF A PROGRAMME PROFILE

### 2.2.1 Programmer Controls

The following controls are used in the programmer mode.

Controller/programmer set-up mode select

This is an alternate action pushbutton for selection of the controller or programmer set-up mode as described in **2.0 CONTROLLER AND PROGRAMMER SET-UP MODES.**

Function (parameter) select

In programmer set-up mode momentary operation of this pushbutton will select a programmer

parameter; repeated operations will select each parameter in turn. If the pushbutton is held down each parameter is automatically selected in turn. The name of the parameter appears in the alphanumeric display with the value in the numeric display.

Parameter raise

This pushbutton is used to increment the value of a selected parameter. The value of the parameter is displayed on the numeric display.

Parameter lower

This pushbutton is used to decrement the value of a selected parameter. The value of the parameter is displayed on the numeric display.

Momentary operation of either the or pushbutton causes the parameter value to change by one least significant digit. If the control is held down the value of the parameter is changed at a rate of 25 units/sec. after 1 second and 250 units/sec. after 8 seconds.

Program run/hold

This pushbutton is used to start (run) the program that has been entered by the operator (see 2.2.7 Running the Program). This control can be used to freeze (hold) the program or terminate (abort) the running of the program. If the Remote Program Start option (Code X10) is fitted, the program can only be started by closing the external contacts (see Section 7.1)

### 2.2.2 Programmer Parameters

For each stage of the programme two sets of parameters are required. One set defines the 'ramp' and the other set defines the 'dwell' period. One further parameter allows the number of 'cycles' to be selected.

a) Ramp Parameters

The programming of ramps can be either by the 'time' or the 'rate' (slope) method. The method of ramp programming is selected by a switch inside the instrument, details are given in 3.0 Internal Switches. In either case, it is necessary to first enter the final temperature of the ramp. In addition the 'time' method involves entering the time duration of the ramp (HRS:MINS).

Alternatively the 'rate' method involves entering the rate of increase (or decrease) of the ramp in units per hour (e.g. °F/HR).

A different set of parameters is displayed for each ramp programming method as shown in the following table.

| PARAMETER | ALPHANUMERIC DISPLAY | IS PARAMETER LOCKABLE? |
|---|---|---|
| FINAL TEMPERATURE (or FINAL VALUE) | TEMP (or FVAL) | Yes |
| TIME DURATION | TIME | Yes |
| STATE OF EVENT O/P (OPTIONAL) | EVNT | Yes |

TABLE 3.6 TIME METHOD OF RAMP PROGRAMMING

| PARAMETER | ALPHANUMERIC DISPLAY | IS PARAMETER LOCKABLE? |
|---|---|---|
| FINAL TEMPERATURE (or FINAL VALUE) | TEMP (or FVAL) | Yes |
| RAMP RATE | /HR | Yes |
| STATE OF EVENT O/P (OPTIONAL) | EVNT | Yes |

TABLE 3.7 RATE METHOD OF RAMP PROGRAMMING

b) Dwell (Soak) Parameters

| PARAMETER | ALPHANUMERIC DISPLAY | IS PARAMETER LOCKABLE? |
|---|---|---|
| TIME DURATION | TIME | Yes |
| STATE OF EVENT O/P (OPTIONAL) | EVNT | Yes |

TABLE 3.8 DWELL PARAMETERS

c) Number of Cycles

The following parameter appears at the end of setting up all parameters for stage 4.

| PARAMETER | ALPHANUMERIC DISPLAY | IS PARAMETER LOCKABLE? |
|---|---|---|
| PROGRAMME REPEATS | CYCL | Yes |

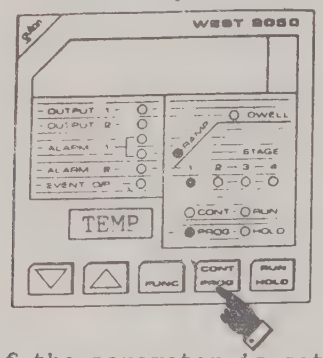
**TABLE 3.9 CYCLE PARAMETER**

### 2.2.3 Setting Up Programmer Parameters

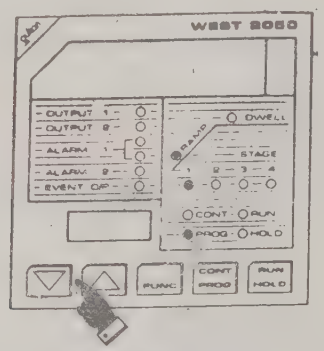
All the displayed programmer parameters can be altered by the operator, provided a programme is not running and the front panel is not locked.

The complete sequence required to programme the 2050 is described in steps (i) to (x) below.

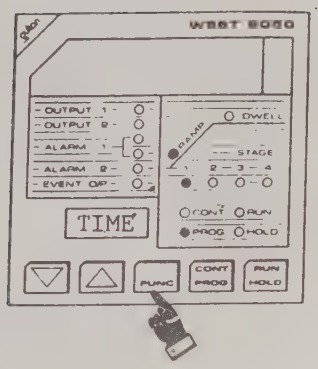
i) First make sure the instrument is in the programmer set-up mode (i.e. CONT PROG has been pressed until the PROG LED is illuminated). The STAGE 1 and RAMP LEDs will also be illuminated, and the first parameter (TEMP or FVAL) of Stage 1 Ramp will be displayed.



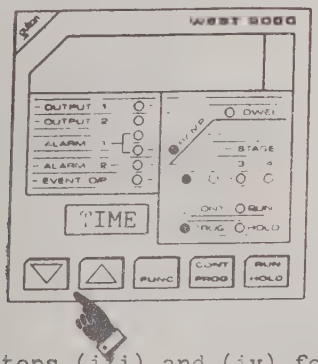

ii) The value of the parameter is set using the raise or lower pushbuttons.



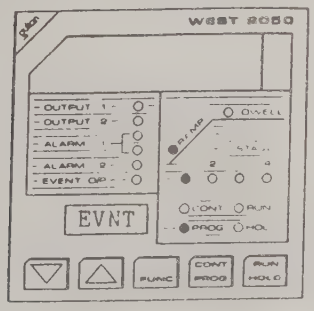

iii) Select the next parameter by momentarily operating the FUNC pushbutton. The STAGE 1 and RAMP LEDs will remain illuminated. The alphanumeric display will indicate TIME or /HR depending on whether the 'Time' of 'Rate' method of Ramp programming has been selected. See Section 3.4.




iv) The value of the parameter is set using the raise or lower pushbuttons.

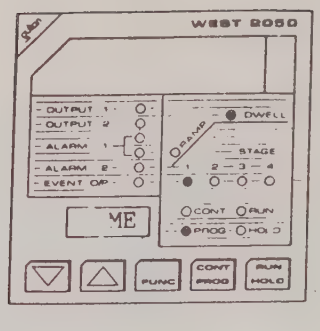



v) Repeat steps (iii) and (iv) for selection and adjustment of the next Programmer Parameter. If the instrument is supplied with the optional Event Output, the next parameter displayed will be EVNT. With this parameter, the raise and lower controls can only be used to set the parameter value to '1' (event relay 'on') or '0' (event relay 'off'). If the value is set to '1' this will cause the event relay to operate during Ramp 1. The STAGE 1 and RAMP LEDs will remain illuminated throughout this step.



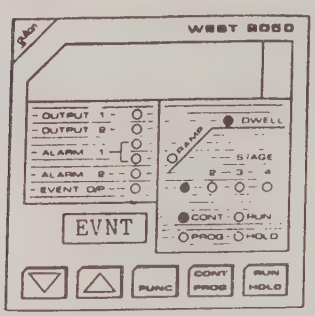

Note. If the instrument is not supplied with the optional Event Output, this step (v) is omitted.

vi) Repeat steps (iii) and (iv) for selection and adjustment of the next parameter, which is the first parameter (TIME) of Dwell 1. Note that




the RAMP LED is now extinguished and the DWELL LED is illuminated. The STAGE 1 and PROG LEDs remain illuminated.

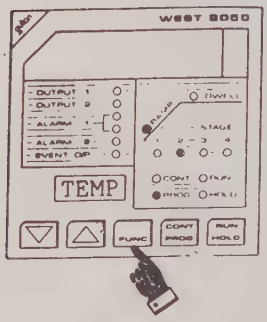
vii) Repeat steps (iii) and iv) for selection and adjustment of the next parameter.




If the Event Output option is fitted, the next parameter displayed will be EVNT.

Note. If the Event Output option is not fitted, this step (vii) is omitted.

viii) Note that at the completion of step (vii), the first profile stage (Ramp and Dwell) has been completely programmed. Select the next parameter by momentarily operating the

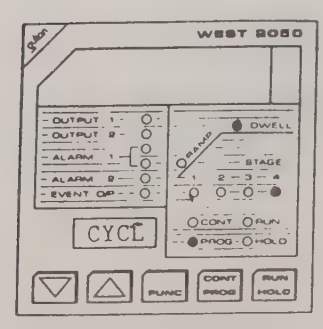



FUNC

pushbutton. The STAGE 2 and RAMP LEDs will now be illuminated, and the first parameter (TEMP) of Stage 2 Ramp will be displayed. Repeat steps (ii) to (vii) to complete the programming for Stage 2 (Ramp and Dwell).

ix) Repeat step (viii) for profile Stage 3 and Stage 4. If any stage (or any individual Ramp or Dwell) is not required, it can be eliminated by setting the appropriate Ramp and Dwell times to zero.

x) At the completion of step (ix) all four profile stages have been completely programmed, and there is only 1 more parameter to be set up. This last parameter (CYCL) is selected by once more operating the




FUNC

pushbutton. Use of the raise and lower pushbuttons will allow any number of repetitive cycles (up to 9999) of the complete profile to be programmed.

### 2.2.4 Programmer Parameter Ranges

The allowable range for each of the programmer parameters is summarised below.

| PARAMETER | RANGE AND NOTES |
|---|---|
| TEMP* or FVAL | Range minimum to setpoint limit |
| TIME | Zero to 99 hrs 59 mins in increments of 1 min (.01) |
| /HR | 1 to 9999 units/hr |
| EVNT | 0 = OFF 1 = ON |
| CYCL | 1 to 9999 cycles. If attempt is made to raise above 9999, cycling is infinite! |

*The first parameter normally appears as TEMP, but will appear as FVAL if the instrument is fitted with a linear input.

**TABLE 3.10 PROGRAMMER PARAMETER RANGES**

### 2.2.5 Altering a Programme

If a minor alteration is required to the existing programme, it is not necessary to re-programme all parameters. The procedure is basically as described in 2.2.3 except that the raise and lower pushbuttons are not used for parameters which do not require changing. Once all required parameters have been changed the programme can be run. It is not necessary to step through all subsequent (non-changing) parameters.

### 2.2.6 Default Values

Unless otherwise specified the instrument is supplied with the programmer parameters set to the following default values.

| PARAMETER | DEFAULT VALUE |
|---|---|
| TEMP or FVAL | Range minimum |
| TIME or RATE | 1.00 HR or 60/HR |
| EVNT | 0 * |
| CYCL | 1 |

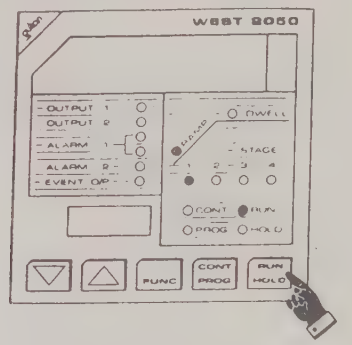
* If option included

**TABLE 3.11 PROGRAMMER PARAMETERS - DEFAULT VALUES**

### 2.2.7 Running the Programme

After all of the parameters have been set up, the programme is started (Run) by pressing the

pushbutton. The RUN LED illuminates. In the 'run' mode it is not possible to alter the initial setpoint value or any of the programmer parameters from the front panel.




This pushbutton can also be used to 'hold' (freeze) the programme by momentarily pressing it again. Both the RUN and HOLD LEDs will now be illuminated.

The programme will continue from the point it was held if the control is momentarily pressed again. The HOLD LED will extinguish.

2.2.8 If the Remote Program Start option (Product Code X10) is fitted the program can only be started by closing the external Remote Program Start contacts.

### 2.2.8 Programme Status Indicators

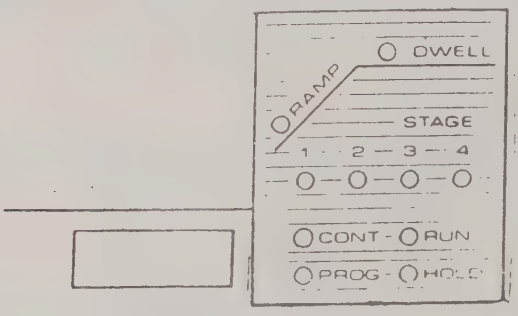
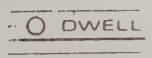



**FIGURE 3.6 PROGRAMME STATUS INDICATORS**

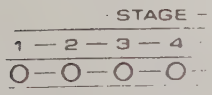
In the RUN or HOLD modes the programme status is indicated by the LEDs in the orange area. The descriptions below assume that the RUN and/or HOLD LEDs are illuminated.

a) Programme Status LEDs

Indicates that the programme being run (or held) is on a ramp.




Indicates that the programme being run (or held) is on a dwell.

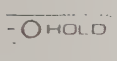



Indicates which stage of the programme is being run (or held).

Indicates that the controller parameters are being reviewed.

Indicates that the programmer parameters are being reviewed.

Indicates that the programme is running.




Indicates that the programme has been held by operator intervention.

b) Alphanumeric Display Messages

While a programme is running or being held, and provided both the CONT and PROG LEDs are off, pressing

displays scrolling messages as described below. The process value is continuously displayed in the numeric display.

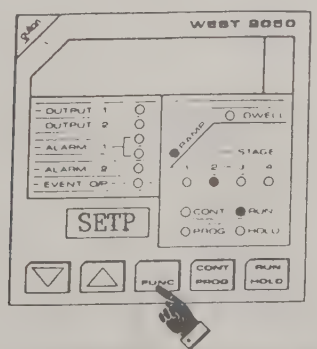



**FIGURE 3.7 ALPHANUMERIC SCROLLING MESSAGES**

i) Momentarily press and release FUNC

SETPOINT = (value) is displayed

ii) Momentarily press and release FUNC again

TIME REMAINING = (HRS:MINS) is displayed

[or TIME ELAPSED = (HRS:MINS) is displayed (i.e. time elapsed in segment) if in WAIT period for instruments with Guaranteed Soak option (see 3.2 Guaranteed Soak).]

iii) Momentarily press and release FUNC again

CYCLES COMPLETED = (number) is displayed.

[If cycles completed >9999

CYCLES COMPLETED >9999

is displayed.]

iv) If the pushbutton is momentarily pressed again the display becomes blank.

### 2.2.9 Review of Parameters during 'run' or 'hold'

Programmer or controller parameters can be reviewed during a programme by first pressing CONT PROG

(the corresponding CONT or PROG LED will be illuminated).

Press FUNC to review each parameter in turn.

While reviewing programmer parameters the appropriate stage, ramp and dwell LEDs flash to highlight the fact that they are not indicating the current 'run' status.

The alphanumeric display shows the parameter name.

The numeric display shows the parameter value.

For most parameters the display will revert 8 seconds after the last pushbutton operation.

### 2.2.10 Segment Advance

Whilst a programme is running a segment (ramp or dwell) can be skipped by pressing [▽] and [△] together (not if the CONT or PROG LEDs ON). Cycles completed during skip are incremented accordingly.

If the controls are held down the skips are at a rate of two segments per sec. after a one second pause.

### 2.2.11 Programme End

When the programme has ended the message [END] is displayed in the alphanumeric display. The setpoint will return to the initial setpoint value.

### 2.2.12 Programme Abort

Press [RUN HOLD] and keep pressing until ABRT message appears.

Initially both the RUN and HOLD LEDs will illuminate. A few seconds later the RUN and HOLD LEDs will flash. (If the pushbutton is released while the LEDs are flashing the programme will be held and the RUN and HOLD LEDs will remain illuminated.)

After a further five seconds of pressing down the pushbutton the programme will abort and the setpoint will return to the initial setpoint value.

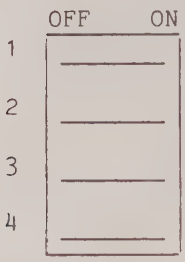
[ABRT] appears on the alphanumeric display and all parameters are reset to those pertaining at the start of the programme.

## 3.0 INTERNAL FEATURE SELECTION

There is a block of 4 switches mounted on the CPU printed circuit board, which are used to select or de-select certain standard internal options.

To gain access to the switches the instrument must be removed **as described in Section 2, 4.0.** For the positions **of the switches see Figure 4.1.**

The functions of the switches (numbered 1 to 4 from top to bottom) are as follows.




| | SWITCH POSITION | |
|---|---|---|
| | OFF | ON |
| S1 | FRONT PANEL UN-LOCKED | FRONT PANEL LOCKED |
| S2 | NO GUARANTEED SOAK | GUARANTEED SOAK |
| S3 | COLD START | PROGRAMME RECOVERY ON POWER FAIL |
| S4 | TIME-MODE RAMP PROGRAMMING | RATE-MODE RAMP PROGRAMMING |

**TABLE 3.12 INTERNAL SWITCH FUNCTIONS**

3.1 SWITCH 1 - LOCK

Unless otherwise specified the instrument is supplied with this switch (S1) in the OFF position (unlocked). With the front panel unlocked, all controller and programmer parameters can be altered if required. (RUN LED must also be OFF to alter programmer parameters.)

With S1 in the ON (locked) position it is not possible to alter any parameter, except the initial setpoint value (or the security code itself), without first entering the predetermined security code. This facility can be used to prevent unauthorised alteration to the controller or programmer set-up parameters.

If it is desired to use the security facility, the general principle is to set up a security code (LOCK) with S1 in the unlocked position. Then S1 is moved to the locked position, and the front panel is locked. To unlock the front panel, it is necessary to select the security parameter (CODE) and duplicate the preset code. The full procedure is detailed below:-

a) With the instrument in the 'Controller set-up' mode and S1 in the unlocked position, select the security parameter (LOCK).

b) Using the raise and lower pushbutton enter the desired security code (between 0 and 9998).

c) Switch off the mains (line) supply to the instrument and remove it from its housing.

d) Change S1 from the unlocked to the locked position.

e) Replace the instrument in its housing and switch on the mains (line) supply. The front panel is now locked.

f) To unlock the front panel, select the security parameter (CODE) and enter the predetermined security code before attempting alteration of the lockable parameters.

g) After altering any parameter values as required, it is recommended that the security code entry be changed to prevent unauthorised access to the code.

Security code 9999 may be selected in (b) above. If this is done it is not possible to unlock the front panel with S1 in the 'locked' position.

Note. Any attempt to alter a locked parameter will cause the upper display to flash.

## 3.2 SWITCH 2 - GUARANTEED SOAK

Unless otherwise specified the instrument is supplied with this switch (S2) in the off position (i.e. no guaranteed soak).

With S2 in the on position (i.e. guaranteed soak facility) the instrument waits following each ramp period, until the value of the measured variable is equal to the relevant set-point value, before starting the next dwell. During the time between the end of the relevant ramp and the start of the dwell 'WAIT' is displayed on the alphanumeric display and the 'TIME REMAINING' message is replaced by a 'TIME ELAPSED' message (TIME ELAPSED = HRS:MINS).

The display will revert to its normal functions when the wait period is over.

## 3.3 SWITCH 3 - PROGRAMME RECOVERY ON POWER FAIL

Unless otherwise specified the instrument is supplied with S3 in the cold start (i.e. OFF) position.

In the event of power failure to the instrument while a programme is running the following two start up alternatives are available.

COLD START (S3 - OFF). The programme is aborted. When power is reconnected the message ABRT is displayed on the alphanumeric display. The programme will start, at the beginning of ramp 1, when the RUN pushbutton is pressed.

Programme RECOVERY ON POWER FAIL.(S3-ON). When power is reconnected the programme will resume from where it was at the time of the power failure.

## 3.4 SWITCH 4 - TIME/RATE MODE OF RAMP PROGRAMMING

Unless otherwise specified the instrument is supplied with S4 in the time mode (i.e. OFF) position.

The following methods of determining the ramp slope are available.

TIME (S4 - OFF). For each ramp the total time in HRS:MINS is entered.

RATE (S4 - ON). For each ramp the rate of change of setpoint value in units/HR is entered.

When the instrument is powered up after changing the position of this switch, the message MODE is shown on the alphanumeric display and the ramp slope parameters revert to the appropriate default values.

| S4 POSITION | DEFAULT VALUE |
|---|---|
| TIME MODE (S4 OFF) | 1 HR |
| RAMP MODE (S4 ON) | 60/HR |

**TABLE 3.13**
**S4 DEFAULT VALUES**

The ramp slope parameters must therefore be reset to the desired values after each change of position of S4.

## 4.0 TUNING OF CONTROLLER

When despatched from the factory, the instrument is programmed with a 'default' set of PID terms (see section 2.1.4). For certain applications it may be felt desirable to use other PID terms in order to improve the control characteristics (for example to avoid overshoot etc.). The procedure for determining the 'optimum' PID terms for a given application is known as 'tuning'.

Note. The instrument can only be tuned for a particular process at a specific setpoint value. The setpoint value should be selected to suit the programme and the process application. It is recommended that the instrument is operated as a controller only (i.e. RUN LED OFF) during the initial tuning procedures.

Relatively simple techniques are described for the tuning of the following :

a) Instrument with Output 1 only

b) Instrument with Output 1 and 2

### 4.1 Tuning Instruments with Output 1 Only

Before starting to tune the instrument, check the following parameters:

a) The power limit YMAX (PMX%) has been set to the required level as described below.

i) Setting power limit

This is used to limit the power level on Output 1 and may be used to protect the process.

It should be set at a value sufficiently high to enable the measured variable to achieve the desired setpoint. If no process protection is necessary, it may be left at the default value (100% PWR).

b) The cycle time TYH (CTH) should be set to suit the type of process to be controlled and also the type of output.

For relay outputs the cycle time should be set as large as possible consistent with satisfactory control in order to maximise relay life.

Instruments with an SSR or thyristor output use a

range of shorter cycle times on Output 1 where the maximum is eight seconds.

c) The setpoint limit WMAX (SPMX) is used to limit the local setpoint and prevent damage to the process. The minimum to which it can be set is the highest value of the setpoint in the programme.

The following techniques are suitable for processes that are not harmed by large fluctuations in the process variable. They provide acceptable values from which to start fine tuning for a wide range of processes. For additional information on tuning, including alternative tuning techniques, refer to the book "Principles of Temperature Control", available from WEST.

### 4.1.1 Technique 1

This is a technique for determining values for the proportional band PB(XP%), integral RST (TN) and derivative RATE (TV).

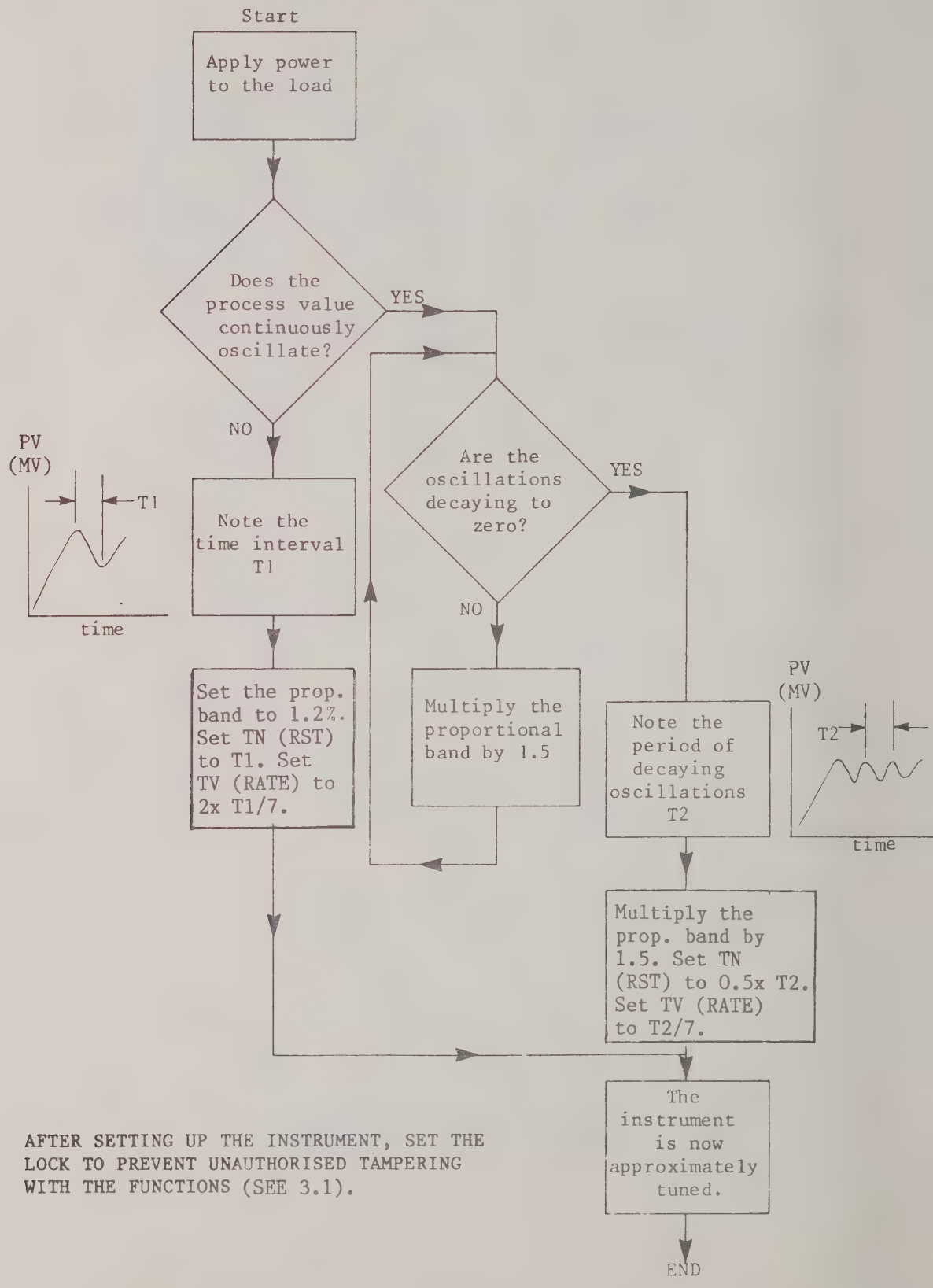
a) Set the setpoint to an appropriate value.

b) Set the proportional band [PB% (XP%)] to 0.5%.

Set the integral [RST (TN)] to OFF (to turn the integral off raise its value until the display becomes blank).

Set the derivative [RATE (TV)] to zero.

c) Switch on the process and follow the instructions in the following chart. At each stage allow sufficient time before moving on to the next stage.


Start
Apply power to the load
Does the process value continuously oscillate?
YES
NO
PV (MV)
T1
time
Note the time interval T1
Set the prop. band to 1.2%. Set TN (RST) to T1. Set TV (RATE) to 2x T1/7.
Are the oscillations decaying to zero?
YES
NO
Multiply the proportional band by 1.5
Note the period of decaying oscillations T2
PV (MV)
T2
time
Multiply the prop. band by 1.5. Set TN (RST) to 0.5x T2. Set TV (RATE) to T2/7.
The instrument is now approximately tuned.
END

**AFTER SETTING UP THE INSTRUMENT, SET THE LOCK TO PREVENT UNAUTHORISED TAMPERING WITH THE FUNCTIONS (SEE 3.1).**



**FIGURE 3.8 TUNING THE CONTROLLER - TECHNIQUE 1**

4.1.2 Technique 2

a) Set the setpoint to an appropriate value.

b) Set the proportional band to 0%, (this sets the instrument to ON/OFF control [PB% (XP%)]. (The integral [RST (TN)] and derivative [RATE (TV)] will be skipped when selecting parameters.)

c) Switch on the process.

Under these conditions the process will oscillate about the setpoint.

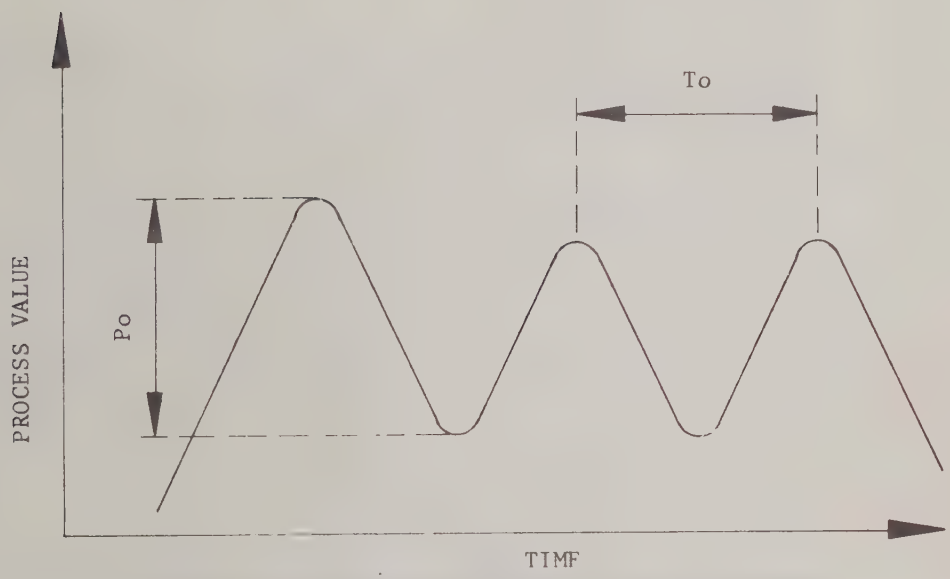



**FIGURE 3.9 OSCILLATION OF PROCESS ABOUT SETPOINT**

Make a note of the following:

i) The peak to peak variation (Po on the illustration of the first cycle, i.e. the difference between the highest value of the first overshoot and the lowest value of the first undershoot.)

ii) The cycle time (To on the illustration) of this oscillation in minutes.

d) The control setting should then be set as follows

Proportional band XP% (PB%)

$$= \frac{Po}{\text{Scale range}} \times 100$$

Integral time RST (TN) = To minutes

Derivative time (RATE (TV)= To/6 minutes

AFTER SETTING UP THE INSTRUMENT, SET THE LOCK TO PREVENT UNAUTHORISED TAMPERING WITH FUNCTIONS.

## 4.2 Tuning Instruments with Output 1 and Output 2

(e.g. Heat/Cool)

BEFORE STARTING TO TUNE THE INSTRUMENT TO THE LOAD, CHECK THAT THE POWER LIMIT YMAX (PMX%) HAS BEEN SET TO THE REQUIRED LEVEL.

For instruments with both outputs the parameters set up in the tuning are as follows:

| | |
|---|---|
| *Proportional Band | PB% (XP%) |
| Integral | RST (TN) |
| Derivative | RATE (TV) |
| *Relative Gain | RCG (XP2) |
| *Deadband/Overlap | OVL% (XSH%) |

The relationship between the 3 parameters marked with an asterisk above and the instrument output is shown in the following illustration:

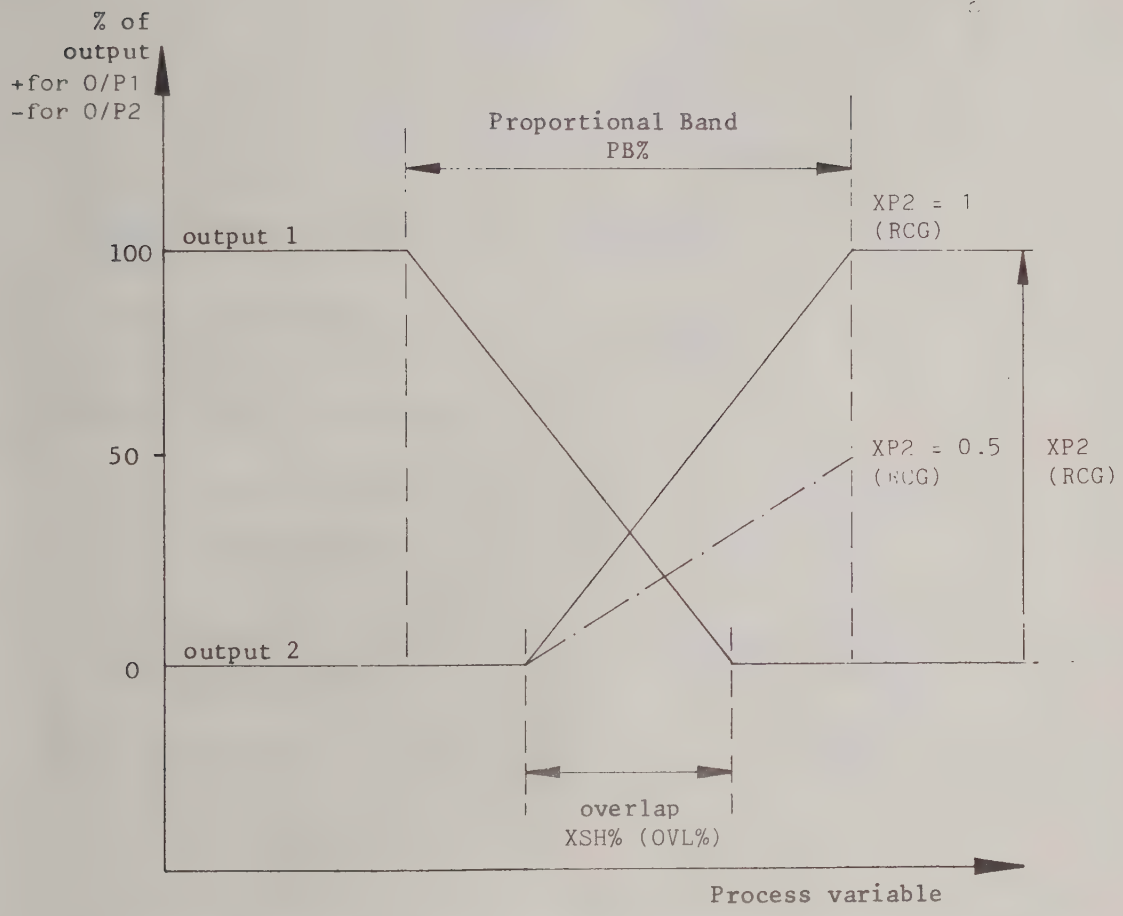



**FIGURE 3.10 RELATIONSHIP BETWEEN PARAMETERS - OUTPUT 1 AND 2 INSTRUMENTS**

### 4.2.1 Procedure

a) The cycle time TYK (CTC) for output 2 should be set to the time appropriate for the process (e.g. 32 seconds for relay output 2 and 2 seconds for SSR output 2).

b) Set the overlap OVL% (XSH) to 0

c) Set the relative gain RCG (XP2) to 1.00

d) With the power supply connected to the machine heater, but with the machine not running, carry out either of the tuning methods described in Section 4.1.

e) Start the machine and observe the process oscillation (if any) about the setpoint.

f) Follow the instructions given in the following chart.

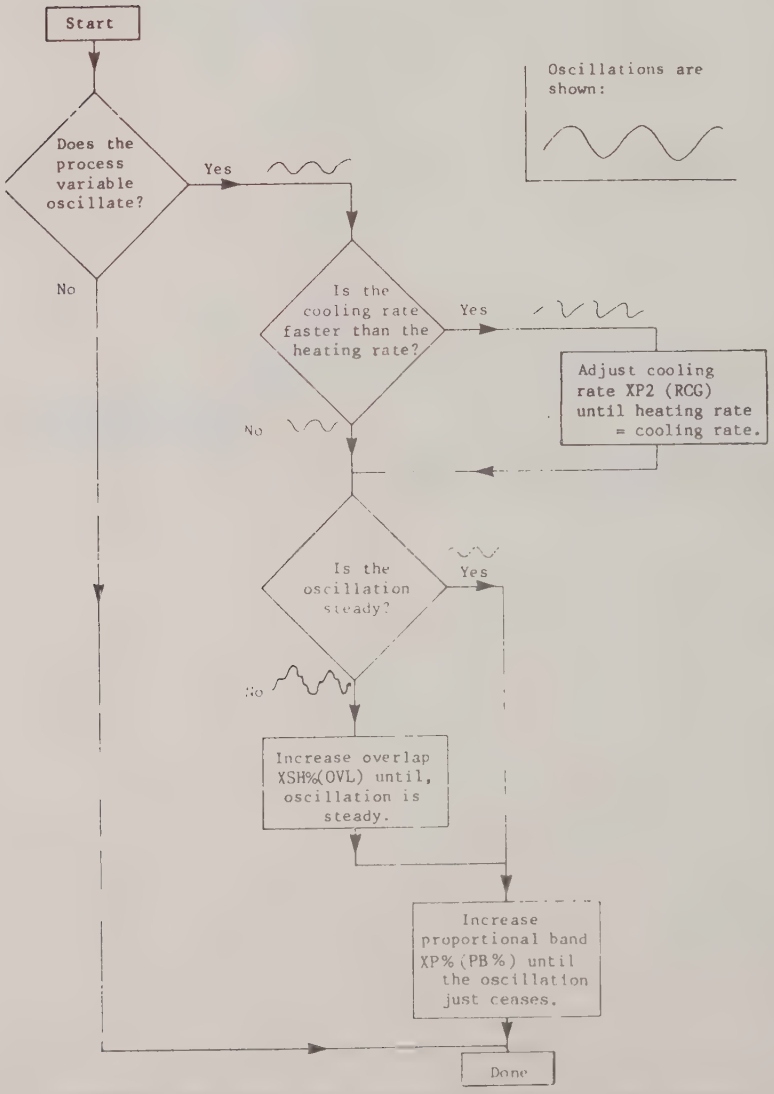



**FIGURE 3.11 INSTRUCTION CHART FOR TUNING OUTPUT 1 AND OUTPUT 2 INSTRUMENTS**

## 5.0 VMD INSTRUMENTS - SETTING UP

An adjustable hysteresis (deadband) can be set up to ensure that the valve motor is de-energised prior to the valve reaching the desired position (final position is achieved due to the inertia inherent in the system). The control (marked RV1) is located on the option board (near the terminal contacts). It should be set to its minimum position, fully counter clockwise.

When the process is close to setpoint, the valve will "hunt". Turn the RV1 control clockwise until the valve stops hunting.

## 6.0 ALARMS - SETTING UP

### 6.1 Alarm 1

This alarm is a deviation alarm which may be:

a) high deviation, direct or reverse acting

b) low deviation, direct or reverse acting

c) limit comparator direct or reverse acting (band alarm)

The deviation alarm value is set using the controller parameter ALM1.

Operation of the red and green indicators is shown in Figure 3.12.

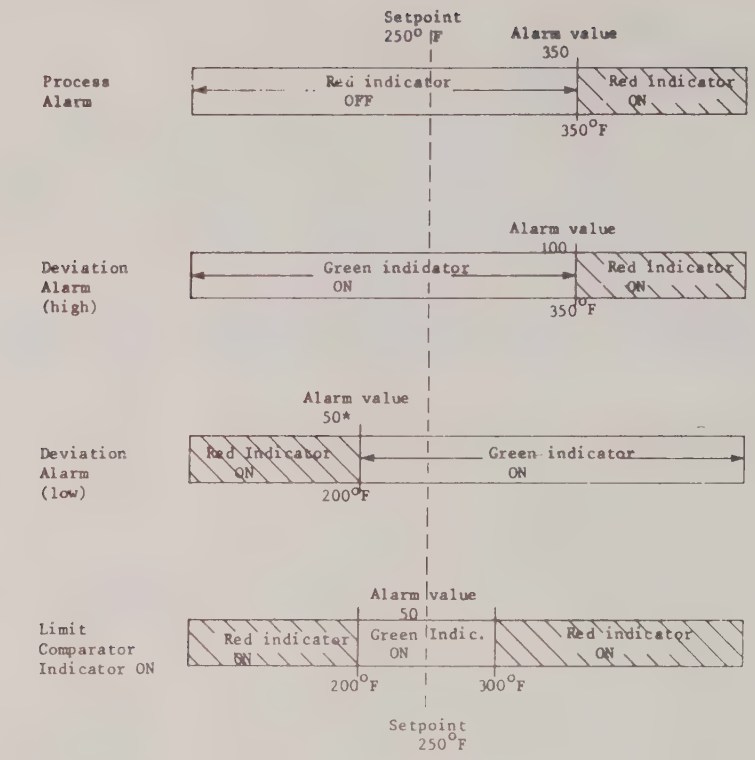



**FIGURE 3.12 ACTION OF ALARMS**

6.2 Alarm 2

This alarm is a process alarm. The red indicator will be ON when the measured variable is greater than the preset value. The preset value is entered using the controller parameter ALM2.

AFTER SETTING UP THE INSTRUMENT, SET THE LOCK TO PREVENT UNAUTHORISED PERSONNEL TAMPERING WITH THE FUNCTIONS. (For setting the lock see 3.1.)

7.0 OPTIONS

The following options are described:

7.1 Remote Programme Start (Option Code X10)

7.2 Event Output (Product Code C--56 or C--57).

## 7.1 Remote Programme Start (Option Code X10)

This option provides a remote programme RUN/HOLD facility by means of external voltage-free contacts.

With the external contacts closed the instrument goes into the RUN status. If the external contacts are then opened the instrument goes into the HOLD status. Closing the external contacts again will cause the instrument to go back to the RUN status.

When this option is fitted the RUN/HOLD pushbutton, on the front panel, operates as an "abort-only" control. (This pushbutton should be pressed for at least eight seconds to abort a programme.) It is not possible to RUN or HOLD a programme from the front panel or to abort a programme by means of the external contacts.

If the programme is aborted while the external contacts are closed these contacts must be opened and closed again to start the run.

## 7.2 Event Output

This option provides SPDT relay contacts which will operate for the duration of a segment (ramp or dwell) of a programme. These contacts can be used to control external auxiliary equipment. The relay operation can be energised or de-energised for each segment of the programme.

# SECTION 4

# RERANGING AND RECONFIGURING

## 1.0 GENERAL

Reranging and reconfiguring the instrument is by the use of link jumpers on the PCBs. Reconfiguration to another variant is possible only if the relevant hardware is fitted. Details are given in this section on all the movable link jumpers on each board.

The information is divided into the following headings:

1) Inputs

2) Outputs

3 Alarms

4) Thermocouple break protection

5) Mains line voltage

6) Event Output

7) CPU Link jumpers

8) Internal (CPU) switches

## 2.0 INPUTS

There are four categories of inputs :

1) Thermocouple range and type
2) RTD range
3) Linear voltage range
4) Linear current range

NOTE: Range changing is confined to range changing within one category, i.e. between thermocouples. Link jumpers on both the CPU board and the Input Output Board need to be changed. Figure 4.1 shows the positions of the boards.

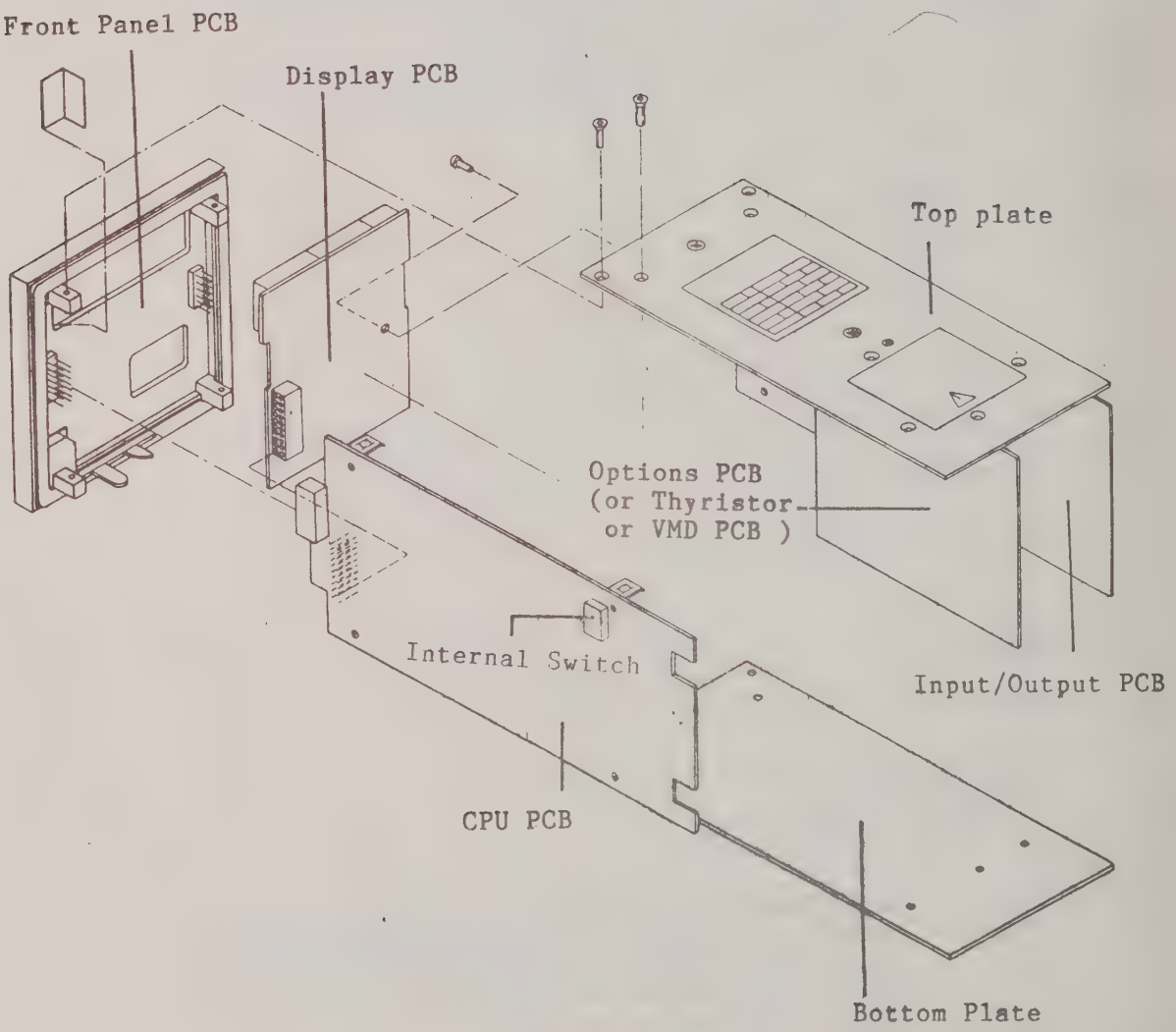



**FIGURE 4.1 EXPLODED VIEW OF THE 2050 SHOWING PCBs**

## 2.1. Range Changing Procedure

1) Remove the instrument from its case as described in Section 2.4.

2) Remove the screws from the bottom plate and remove the plate (see Figure 4.1).

3) All the link jumper positions required for changing the range are now accessible using tweezers or pliers.

The link jumper positions for the CPU board are shown in Figure 4.2. (Figure 4.2 shows the component side of the board). The Input/Output board depends upon the Input/Output combination for the particular instrument.

The following table indicates which illustration shows the correct Input/Output board for a given Input/Output combination.

| INPUT | OUTPUT | SEE FIGURE |
|---|---|---|
| Thermocouple,Linear | Relay,SSR,VMD or Thyristor | 4.3 |
| Thermocouple,Linear | Linear | 4.4 |
| RTD | Relay,SSR,VMD or Thyristor | 4.5 |
| RTD | Linear | 4.6 |

TABLE 4.1 TABLE OF ILLUSTRATIONS FOR INPUT/OUTPUT BOARDS

4) Refer to the label on the top plate of the instrument to determine the input product code . (The one beginning with T).

5) Look up the input code and link jumpers on the tables and using the apropriate figures from Figure 4.1 to 4.6 remove the relevant link jumpers

6) Determine the product code for the new range required and refit the link jumpers in the appropriate position using the tables and figures.

7) Update the instrument product code label located on the top plate of the instrument.

## 3.0 OUTPUTS

A linear output instrument can be reconfigured from or to any of the following outputs :

1) D.C.current 4-20mA
2) D.C.current 0-20mA
3) D.C. voltage 1-5V
4) D.C. voltage 0-5V

Link jumpers of the Input/Output board are used. Figure 4.1 shows the position of the board. Link jumpers on the CPU board may need to be changed, refer to Table 4.5.

NOTE: IT IS NOT POSSIBLE TO CHANGE THE OUTPUT TYPE BY CHANGING THE LINK JUMPERS. EXAMPLE : LINEAR TO VMD.

### 3.1 Procedure

1) Remove the instrument from its case as described in Section 2 - 4.0.

2) Remove the screws from the bottom plate and remove the plate (see Figure 4.1).

3) All the link jumper positions required for changing the output are now accessible using tweezers or pliers.

4) For a thermocouple, linear input instrument see Figure 4.4 for the positions of the link jumpers on the Input/Output board. For a RTD input instrument see Figure 4.6 for the positions of the link jumpers on the Input/Output board.

5) Reconfigure the link jumpers LJ26 to LJ31 on the Input/Output board for the output required from the following table 4.5.

6) Update the product code on the label on the top plate.

## 4.0 ALARMS

Reconfiguration of the alarms is possible, only if the necessary hardware has been fitted to the instrument.

Link jumpers on the Option Board (standard instruments) VMD board (VMD instruments) or Thyristor Output board (Thyristor Output instruments) are used to reconfigure the alarms.

NOTE: 1) ALARM OPTIONS PROVIDED WITH VMD OUTPUT INSTRUMENTS DIFFER TO THOSE PROVIDED WITH OTHER INSTRUMENTS.

2) EVENT OUTPUT AND ALARM 2 ARE MUTUALLY EXCLUSIVE.

### 4.1 Procedure

1) Remove the instrument from its case as described in Section 2 - 4.0.

2) Remove the screws from the bottom plate and remove the plate.

3) Rest the instrument on its top plate.

4) Remove the ribbon cable from the connector on the option board (Figure 4.1 shows which board is the option board).

5) Turn the instrument over and remove the two screws holding the option board to the top plate (remove the flying lead if there is one).

6) If the instrument has a VMD output the CPU board should be removed as follows :

   a) Remove the ribbon cable from the connector on the CPU board.

   b) Remove the two screws which hold the CPU board to the top plate.

   c) Unplug the CPU board from the display board.

   d) With the CPU board it is important not to short out the terminals of the battery. (The position of the battery is shown in Figure 4.2).

7) Note, from the product code chart, the product code for the new alarm options required.

8) Compare the new product code against the appropriate option board variant chart (Table 4.5) and install the appropriate link jumpers. The positions are shown in the relevant Figure 4.7, 4.8 or 4.9.

9) Reconnect the ribbon cable from the Input/Output to the Option board with the insulated side away from the connector contacts.

10) If it is a VMD instrument replace the CPU board as follows :

    a) Plug the CPU board into the display board.

    b) Reconnect the cable to the CPU board with the insulated side away from the connector contacts.

    c) Replace the CPU to the top plate using the original screws.

    d) Carefully replace the front panel.

11) Replace the bottom plate using the original screws

12) Insert the instrument into the case.

13) Update the product code label located on the top plate of the instrument.

## 5.0 THERMOCOUPLE BREAK PROTECTION

For thermocouple input instruments it is possible to select the type of operation under open circuit thermocouple by altering a link jumper on the Input/Output Board.

The types of thermocouple break protection are as follows :

a) Upscale (standard)
b) Downscale
c) No break protection

The link jumper positions for the appropriate Input/Output Board are shown in either Figure 4.3 or Figure 4.4.

### 5.1 Procedure

The procedure for dis-assembly of the instrument is given in the procedure under paragraph 2.1 of this Section.

The link jumper information for thermocouple break protection is given in Table 4.2.

After altering the link jumper position replace the bottom plate of the instrument using the original screws. Reinstall the instrument in its case and amend the product code on the top plate of the instrument as appropriate.

## 6.0 MAINS (LINE) VOLTAGE

Selection for either 240V a.c. or 110V a.c. operation is possible by moving a link jumper on the Input/Output board.

The link jumper information for the mains (line) voltage selection (all Input/Output Boards) is given in the Table 4.5.

The link jumper positions for the appropriate Input/Output Board are shown in Figures 4.3 to 4.6.

### 6.1 Mains (Line) Voltage Change Procedure

The procedure for the dis-assembly of the instrument is given in the procedure in paragraph 2.1 of this Section

After altering the link jumper position replace the bottom plate of the instrument using the original screws.

## 7.0 EVENT OUTPUT

Selection of either the event output or Alarm 2 facility (not both at the same time) is by the use of a link jumper on the front panel PCB.

### 7.1 Procedure

1) Remove the instrument from its case as previously described.

2) Remove the four screws holding the front bezel to the instrument chassis (two in the top plate and two in the bottom plate) - see Figure 4.10.

3) Remove the front bezel and panel from the instrument by firmly pulling the bezel directly away from the instrument, (pull squarely so as not to damage any pin connectors).

4) Details of the link jumper positioning are given below :

   a) For Event Output LJKD7 must be OUT
      LJKD12 must be IN

   b) For Alarm 2 (NO EVENT OUTPUT)
      LJKD7 must be IN
      LJKD12 must be OUT

   c) When neither Event or Alarm 2 are required none of the link jumpers need to be included.

NOTE: LINK J36 ON THE CPU BOARD (SEE FIGURE 4.2) MUST BE IN FOR EVENT OUTPUT

5) Re-assembly is the reverse of the dis-assembly procedure

## 8.0 CPU LINK JUMPERS

LINK JUMPERS NEED TO BE CHANGED ON THE CPU BOARD FOR THE FOLLOWING :

1) Input range changing (see **2.0 INPUTS**).

2) Linear output change involving a voltage output (see **3.0 OUTPUTS**).

3) Possibly for alarm changes (see **4.0 ALARMS**)

4) For other changes see Table 4.5.

### 8.1 Removal of the CPU Board

1) Remove the instrument from its case as described in Section 2 - 4.0.

2) Remove the screws from the bottom plate and remove the plate.

3) Rest the instrument on its top plate.

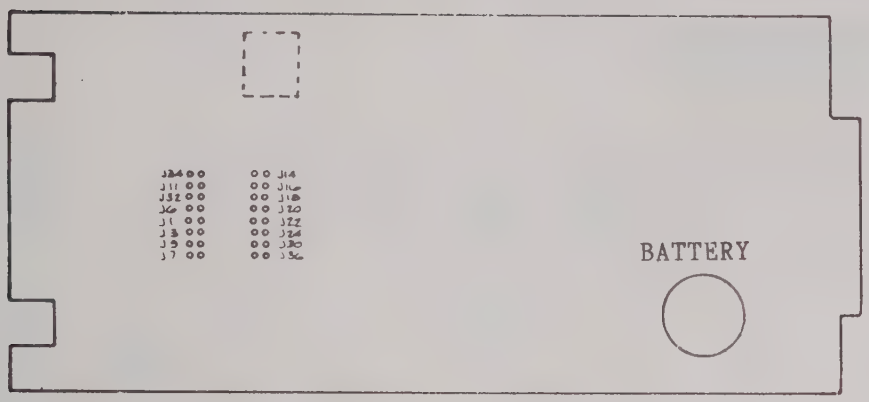
4) Remove the two screws that hold the CPU board to the top plate.

5) Remove the ribbon cable from the connector on the CPU board.

6) Unplug the CPU board from the display board.

7) Be careful not to short out the terminal of the battery. (The positions of the battery and the link jumpers are shown in Figure 4.2).

8) Re-assembly is the reverse of the above procedure




NOTE: When a CPU board link jumper is NOT IN it should be put in the "parked" position as shown below.

| | | |
|---|---|---|
| J34 | 0-0 | 0-0 J14 |
| J11 | 0-0 | 0-0 J16 |
| J32 | 0-0 | 0-0 J18 |
| J6 | 0-0 | 0-0 J20 |
| J1 | 0■ | 0-0 J22 |
| J3 | 0-0 | 0-0 J24 |
| J9 | 0-0 | 0-0 J30 |
| J7 | 0-0 | 0-0 J36 |

Link for J1 in the "parked" position

**FIGURE 4.2 CPU BOARD - LINK JUMPER POSITIONS**

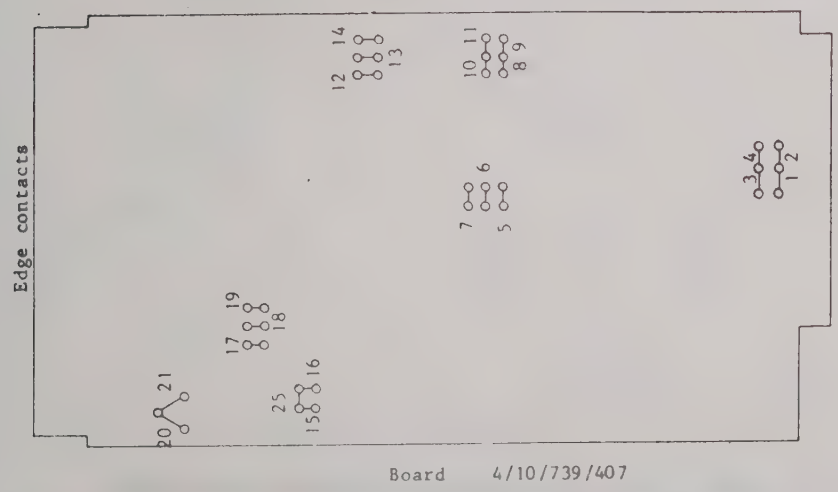



**FIGURE 4.3 THERMOCOUPLE, LINEAR INPUT/ RELAY,SSR, VMD OR THYRISTOR OUTPUT PCB-LINK JUMPER POSITIONS**

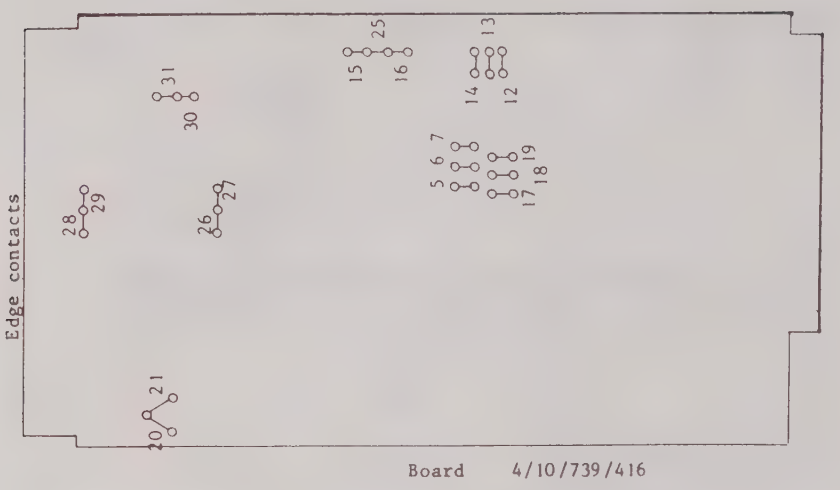



FIGURE 4.4 THERMOCOUPLE, LINEAR INPUT/LINEAR OUTPUT PCB - LINK JUMPER POSITIONS

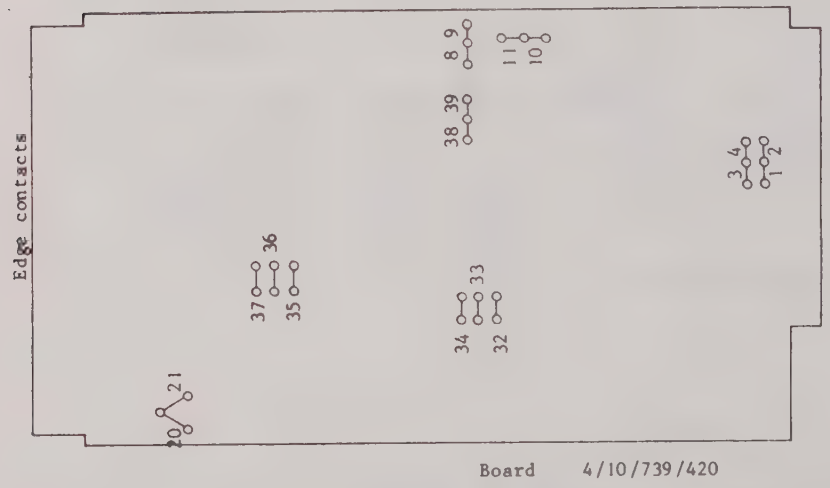



FIGURE 4.5 RTD INPUT/RELAY, SSR, VMD OR THYRISTOR OUTPUT PCB - LINK JUMPER POSITIONS

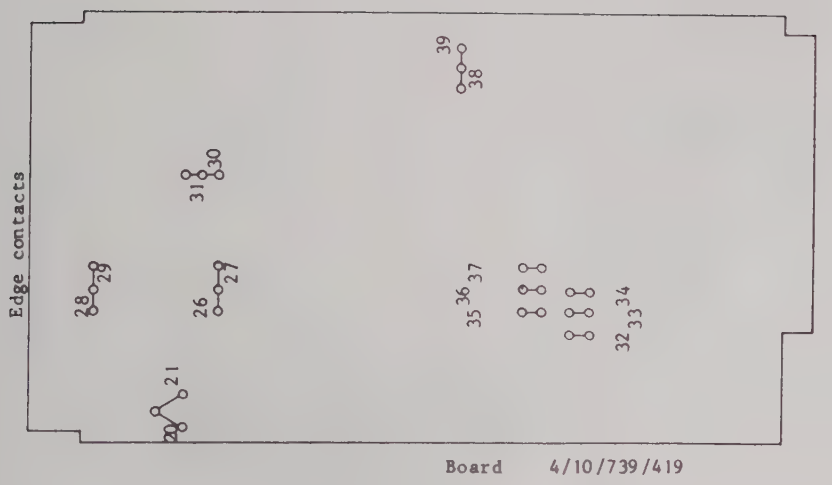



**FIGURE 4.6 RTD INPUT/LINEAR OUTPUT PCB - LINK JUMPER POSITIONS**

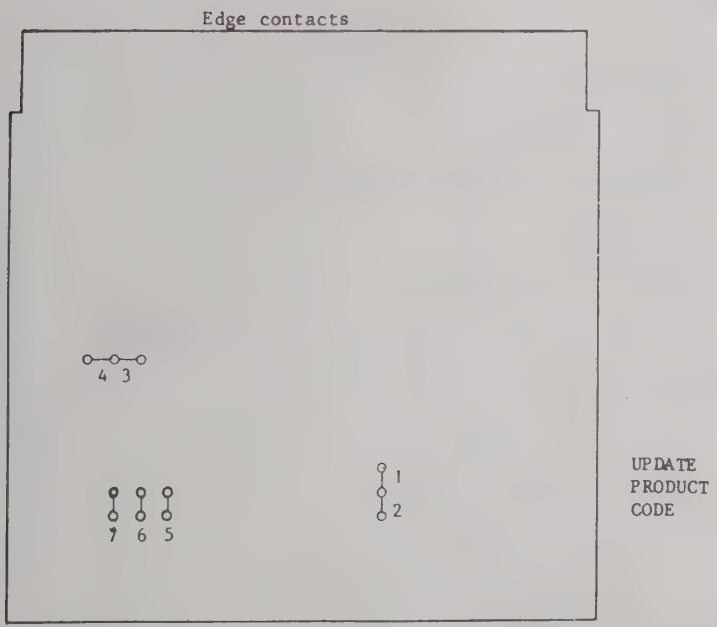



**FIGURE 4.7 OPTION BOARD LINK JUMPER POSITIONS (ALARMS) - STANDARD INSTRUMENTS**

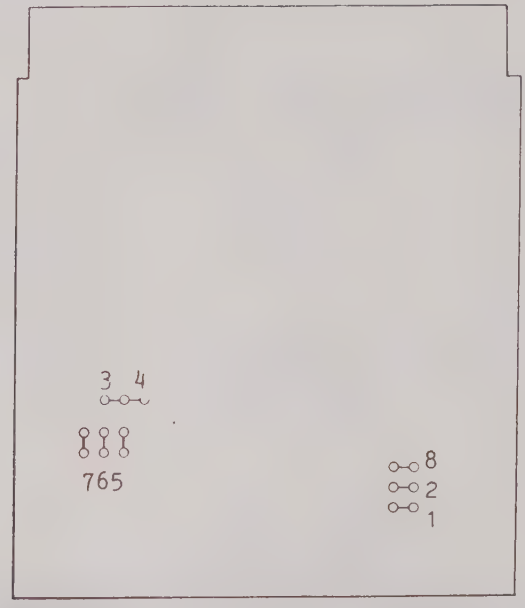



**FIGURE 4.8 OPTION BOARD LINK JUMPER POSITIONS (ALARMS) - THYRISTOR PULSE OUTPUT INSTRUMENTS**

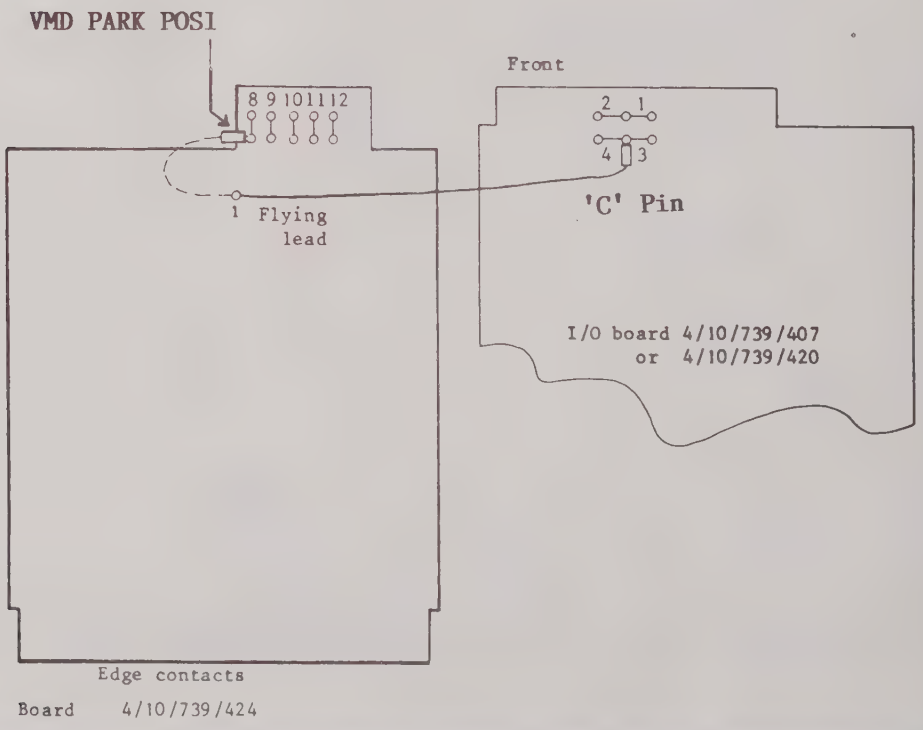



**FIGURE 4.9 OPTION BOARD LINK POSITIONS (ALARMS) - VMD OUTPUT INSTRUMENTS**

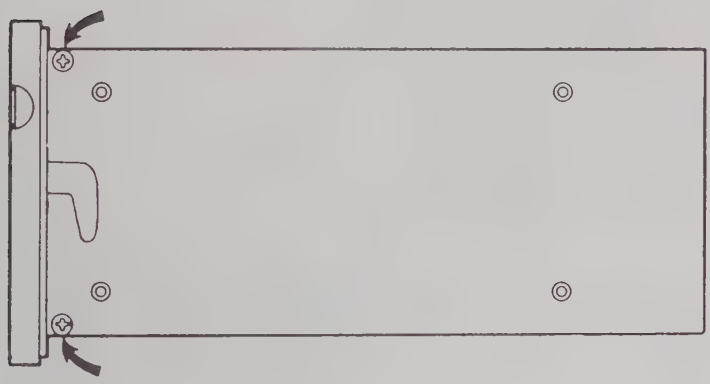


FIGURE 4.10 FRONT BEZEL ATTACHMENT SCREWS

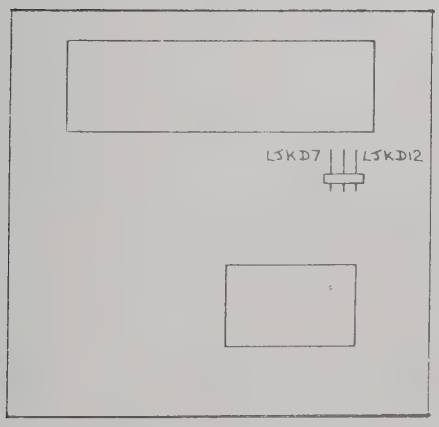



FIGURE 4.11 FRONT PANEL PCB LINK JUMPER POSITIONS - EVENT OUTPUT/ALARM 2

| INPUT PROD.CODE | TYPE | RANGE SCALE | CPU LINK JUMPERS 14 | 16 | 18 | 20 | 22 | 24 | INPUT/OUTPUT PCB LINK JUMPERS 5 | 6 | 7 | 12 | 13 | 14 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T1127 | R | 0-1650°C | | X | X | | | | | | | | | | | | |
| T1128 | | 32-3002°F | | X | X | | X | | | X | | X | | | | | X |
| T1227 | S | 0-1650°C | | | | X | | | | X | | X | | | | | X |
| T1228 | | 32-3002°F | | | | X | X | | | X | | X | | | | | X |
| T1415 | J | 0.0-205.0°C | | X | | | | | | | X | | | X | X | | |
| T1416 | | 32.0-401.0°F | | X | | | X | | | | X | | | X | X | | |
| T1417 | | 0-450°C | X | | | | | | | X | | X | | | | | X |
| T1418 | | 32-842°F | X | | | | X | | | X | | X | | | | | X |
| T1419 | | 0-760°C | X | X | | | | | X | | | | X | | | X | |
| T1420 | | 32-1400°F | X | X | | | X | | X | | | | X | | | X | |
| T1815 | J(DIN) | 0.0-205.0°C | | X | | | | X | | | X | | | X | X | | |
| T1816 | | 32-401.0°F | | X | | | X | X | | | X | | | X | X | | |
| T1817 | | 0-450°C | X | | | | | X | | X | | X | | | | | X |
| T1818 | | 32-842°F | X | | | | X | X | | X | | X | | | | | X |
| T1819 | | 0-760°C | X | X | | | | X | X | | | | X | | | X | |
| T1820 | | 32-1400°F | X | X | | | X | X | X | | | | X | | | X | |
| T1525 | T | -200 to +260°C | X | | | X | | | | | X | | | X | | | X |
| T1526 | | -328 to +500°F | X | | | X | X | | | | X | | | X | | | X |
| T1715 | K | 0.0-205°C | | | X | | | | | | X | | | X | X | | |
| T1716 | | 32.0-401.0°F | | | X | | X | | | | X | | | X | X | | |
| T1721 | | 0-600°C | X | | X | | | | | X | | X | | | | | X |
| T1722 | | 32-1112°F | X | | X | | X | | | X | | X | | | | | X |
| T1723 | | 0-1371°C | X | X | X | | | | X | | | | X | | | X | |
| T1724 | | 32-2500°F | X | X | X | | X | | X | | | | X | | | X | |
| T1983 | B | 100-1820°C | | | | X | | X | | X | | X | | | | | X |
| T1984 | | 212-3308°F | | | | X | X | X | | X | | X | | | | | X |

| THERMOCOUPLE BREAK PROTECTION | | INPUT/OUTPUT BOARD LJs 15 | 16 | 25 |
|---|---|---|---|---|
| T1 - - - | UPSCALE (STANDARD) | | X | |
| T1 - - -21 | DOWNSCALE | X | | |
| T1 - - -22 | NO BREAK PROTECTION | | | X |

TABLE 4.2 THERMOCOUPLE INPUT - CPU AND INPUT/OUTPUT BOARD LINK JUMPERS

| INPUT | | | CPU LINK JUMPERS | | | | | | INPUT/OUTPUT PCB LINK JUMPERS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROD.CODE. | TYPE | RANGE | 14 | 16 | 18 | 20 | 22 | 24 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| T2221 | RTD | 0 to +600°C | | X | | X | | X | | X | | X | | | | X |
| T2222 | RTD | 32 to 1112°F | | X | | X | X | X | | X | | X | | | | X |
| T2230 | RTD | -101.0 to +100.0°C | | X | | X | | | | | X | | | X | X | |
| T2231 | RTD | -150.0 to +212.0°F | | X | | X | X | | | | X | | | X | X | |
| T2232 | RTD | -200.0 to +205.0°C | X | X | | X | | | X | | | | X | | X | |
| T2233 | RTD | -328.0 to +401.0°F | X | X | | X | X | | X | | | | X | | X | |

| PROD.CODE | TYPE | RANGE/SCALE | 5 | 6 | 7 | 12 | 13 | 14 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T3113 | LIN | 0-20mA 0-10.00 | | | X | X | | | | | X |
| T3114 | LIN | 4-20mA 0-10.00 | | | X | X | | | | | X |
| T3213 | LIN | 0-20mA 0-14.00 | | | X | X | | | | | X |
| T3214 | LIN | 4-20mA 0-14.00 | | | X | X | | | | | X |
| T3313 | LIN | 0-20mA 0-50.00 | | | X | X | | | | | X |
| T3314 | LIN | 4-20mA 0-50.00 | | | X | X | | | | | X |
| T3413 | LIN | 0-20mA 0-100.0 | | | X | X | | | | | X |
| T3414 | LIN | 4-20mA 0-100.0 | | | X | X | | | | | X |
| T3513 | LIN | 0-20mA 0-300.0 | | | X | X | | | | | X |
| T3514 | LIN | 4-20mA 0-300.0 | | | X | X | | | | | X |
| T3613 | LIN | 0-20mA 0-700.0 | | | X | X | | | | | X |
| T3614 | LIN | 4-20mA 0-700.0 | | | X | X | | | | | X |
| T3713 | LIN | 0-20mA 0-1000 | | | X | X | | | | | X |
| T3714 | LIN | 4-20mA 0-1000 | | | X | X | | | | | X |
| T3813 | LIN | 0-20mA 0-3000 | | | X | X | | | | | X |
| T3814 | LIN | 4-20mA 0-3000 | | | X | X | | | | | X |

TABLE 4.3 RTD AND LINEAR (PART OF) INPUT - CPU AND INPUT/OUTPUT BOARD LINK JUMPERS

| INPUT | | | | CPU LINK JUMPERS | | | | | | INPUT/OUTPUT BOARD LINK JUMPERS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROD CODE | TYPE | RANGE | SCALE | 14 | 16 | 18 | 20 | 22 | 24 | 5 | 6 | 7 | 12 | 13 | 14 | 17 | 18 | 19 |
| T4110 | LIN | 0-5mV | 0-10.00 | | | X | X | | | | X | | X | | | | | X |
| T4111 | LIN | 0-10mV | 0-10.00 | | | X | X | | | X | | | | | X | X | | |
| T4112 | LIN | 0-100mV | 0-10.00 | | | X | X | | | | | X | | X | | | X | |
| T4210 | LIN | 0-5mV | 0-14.00 | X | | X | X | | | | X | | X | | | | | X |
| T4211 | LIN | 0-10mV | 0-14.00 | X | | X | X | | | X | | | | | X | X | | |
| T4212 | LIN | 0-100mV | 0-14.00 | X | | X | X | | | | | X | | | | | X | |
| T4310 | LIN | 0-5mV | 0-50.00 | | X | X | X | | | | X | | X | | | | | X |
| T4311 | LIN | 0-10mV | 0-50.00 | | X | X | X | | | X | | | | | X | X | | |
| T4312 | LIN | 0-100mV | 0-50.00 | | X | X | X | | | | | X | | X | | | X | |
| T4410 | LIN | 0-5mV | 0-100.0 | X | X | X | X | | | | X | | X | | | | | X |
| T4411 | LIN | 0-10mV | 0-100.0 | X | X | | | | | | | | | | X | X | | |
| T4412 | LIN | 0-100mV | 0-100.0 | X | X | X | X | | | | | X | | X | | | X | |
| T4510 | LIN | 0-5mV | 0-300.0 | | | X | X | X | | | X | | | | | | | X |
| T4511 | LIN | 0-10mV | 0-300.0 | | | X | X | X | | X | | | | | X | X | | |
| T4512 | LIN | 0-100mV | 0-300.0 | | | X | X | X | | | | X | | X | | | X | |
| T4610 | LIN | 0-5mV | 0-700.0 | X | | X | X | X | | | X | | X | | | | | X |
| T4611 | LIN | 0-10mV | 0-700.0 | X | | X | X | X | | X | | | | | X | X | | |
| T4612 | LIN | 0-100mV | 0-700.0 | X | | X | X | X | | | | X | | X | | | X | |
| T4710 | LIN | 0-5mV | 0-1000 | | X | X | X | X | | | X | | X | | | | | X |
| T4711 | LIN | 0-10mV | 0-1000 | | X | X | X | X | | X | | | | | X | X | | |
| T4712 | LIN | 0-100mV | 0-1000 | | X | X | X | X | | | | X | | X | | | X | |
| T4810 | LIN | 0-5mV | 0-3000 | X | X | X | X | X | | | X | | X | | | | | X |
| T4811 | LIN | 0-10mV | 0-3000 | X | X | X | X | X | | X | | | | | X | X | | |
| T4812 | LIN | 0-100mV | 0-3000 | X | X | X | X | X | | | | X | | X | | | X | |

TABLE 4.4 LINEAR INPUT (PART OF) - CPU AND INPUT/OUTPUT BOARD LINK JUMPERS

| ASSY | LJ No. | OUTPUT 1 H 10 | 21 | 24 | 30 | 40 | 50 | OPTION 31 61 | 64 | OUTPUT 2 C 00 | 10 | 50 | ALARM 1 42 | 43 | 44 | 45 | 46 | 47 | ALARM 2 C48 | C49 | EVENT C56 | C57 | OPTIONS * LO1 | LO2 | XO2 | X10 | X15 | X16 | M2050 | M1050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 1 | | | | | | | | | | | | | | | | | | X | X | | | | | | | | | |
| P | 3 | | | | | | | | | | | | X | X | X | X | X | X | 3 | 3 | 3 | 3 | | | | | | | |
| U | 6 | | | | | | | | | | X | X | | | | | | | | | | | | | | | | | |
| P | 7 | X | X | X | X | X | X | X | X | 4 | | | | | | | | | | | | | | | | | | | |
| C | 9 | | | | X | | X | | | | | | | | | | | | | | | | | | | | | | |
| B | 11 | | X | X | | X | | X | X | | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | | | | | | | | | | | | | | X | X | | |
| See | 32 | | | | | | | | | | | | | | | | | | | | | | | | | X | | | 2 |
| Fig. | 34 | | | | | | | | | | | | | | | | | | | | | | | | X | | | | |
| 4.2. | 36 | | | | | | | | | | | | | | | | | | | | X | X | | | | | | | |
| I/O | 20 | | | | | | | | | | | | | | | | | | | | | | | X | | | | | |
| PCB | 21 | | | | | | | | | | | | | | | | | | | | | | X | | | | | | |
| See | 26 | | X | | | | | X | | | | | | | | | | | | | | | | | | | | | |
| Fig. | 27 | | | X | | | | | X | | | | | | | | | | | | | | | | | | | | |
| 4.3 | 28 | | | | | | | X | X | | | | | | | | | | | | | | | | | | | | |
| to | 29 | | X | X | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.6. | 30 | | X | | | | | X | | | | | | | | | | | | | | | | | | | | | |
| | 31 | | | X | | | | | X | | | | | | | | | | | | | | | | | | | | |
| See Fig. 4.9 | 3-4 | | | | | | | | | | | | F L to C' Pin | | F L to C' Pin | | | | | | | | | | | | | | |
| STD. | 1 | | | | | | | | | | | | | | | | | | | X | | X | | | | | | | |
| OPT'N | 2 | | | | | | | | | | | | | | | | | | X | | X | | | | | | | | |
| PCB | 3 | | | | | | | | | | | | | X | | | X | X | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | X | | X | | | X | | | | | | | | | | | |
| See | 5 | | | | | | | | | | | | X | X | | | | | | | | | | | | | | | |
| Fig. | 6 | | | | | | | | | | | | | | X | X | | | | | | | | | | | | | |
| 4.7 | 7 | | | | | | | | | | | | | | | | X | X | | | | | | | | | | | |
| VMD | 8 | | | | | | | | | | | | X | | X | | | | | | | | | | | | | | |
| OPT'N | 9 | | | | | | | | | | | | | | | | | | | X | | X | | | | | | | |
| PCB | 10 | | | | | | | | | | | | | | | | | | | X | | X | | | | | | | |
| See | 11 | | | | | | | | | | | | X | | | | | | | | | | | | | | | | |
| Fig. 4.9. | 12 | | | | | | | | | | | | | | X | | | | | | | | | | | | | | |
| Flying Lead (FL) | | | | | | | | | | | | | To I/O | | To I/O | | | | | Park Pos'n | | | | | | | | | |
| THYR- | 1 | | | | | | | | | | | | | | | | | | | X | | X | | | | | | | |
| ISTOR | 2 | | | | | | | | | | | | | | | | | | X | | X | | | | | | | | |
| OPT'N | 3 | | | | | | | | | | | | | X | | X | X | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | X | | X | | | X | | | | | | | | | | | |
| | 5 | | | | | | | | | | | | X | X | | | | | | | | | | | | | | | |
| See | 6 | | | | | | | | | | | | | | X | X | | | | | | | | | | | | | |
| Fig. | 7 | | | | | | | | | | | | | | | | X | X | | | | | | | | | | | |
| 4.8 | 8 | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | |
| TOUCH PANEL PCB See Fig. 4.11 | D7 | | | | | | | | | | | | | | | | | | X | X | | | | | | | | | |
| | D12 | | | | | | | | | | | | | | | | | | | | X | X | | | | | | | |

NOTES
1) CPU link jumpers 14, 16, 18, 20, 22, 24, must not be touched
2) I/O range link jumpers 5, 6, 7, 2, 12, 13, 14, 15, 16, 17, 18, 19, 22, 25, 32, 33, 34, 35, 36, 37, 38, 39, must not be touched
3) **Table Legend**
Blank = no link
X = Link IN

1 = Include LK8 if ALM 1 only is required.
Delete LK8 if ALM 1 and ALM 2/ EVENT Output are required.
2 = Include LK32 if option X16 is not required.
Delete LK32 if option X16 is required.
3 = Include LK3 if ALM 1 and ALM 2/ EVENT Output are required.
Delete LK3 if ALM 2 only required.
4 = Delete LK7 if option 31 is required.

* For LO4 option consult West.

(FOR VARIANTS NOT SHOWN - SEE PREVIOUS TABLES)

**TABLE 4.5 PCB ASSEMBLY / LINK JUMPERCONFIGURATIONS**

## 9.0 INTERNAL (CPU) SWITCHES

There are four internal switches mounted on a switch block on the wiring side of the CPU board. The functions of the switches are as follows :

| SWITCH NUMBER | SWITCH POSITION | |
|---|---|---|
| | OFF | ON |
| 1 | INSTRUMENT UNLOCKED | INSTRUMENT LOCKED |
| 2 | NO GUARANTEED SOAK PERIOD | GUARANTEED SOAK INSTRUMENT WAITS FOR MEASURED VARIABLE TO REACH FINAL RAMP VALUE OF SETPOINT BEFORE DWELL PERIOD STARTS. |
| 3 | COLD START ON POWER ON AFTER POWER FAIL (PROGRAMME ABORT) | PROGRAMME RECOVERY ON POWER ON AFTER POWER FAIL (PROGRAMME RESUMES WHERE LEFT OFF) |
| 4 | TIME RAMP MODE | RATE RAMP MODE |

TABLE 4.6 INTERNAL (CPU) SWITCHES

The location of the switch block is shown in Figure 4.12
The switch block is readily accessible with the instrument removed from its case.

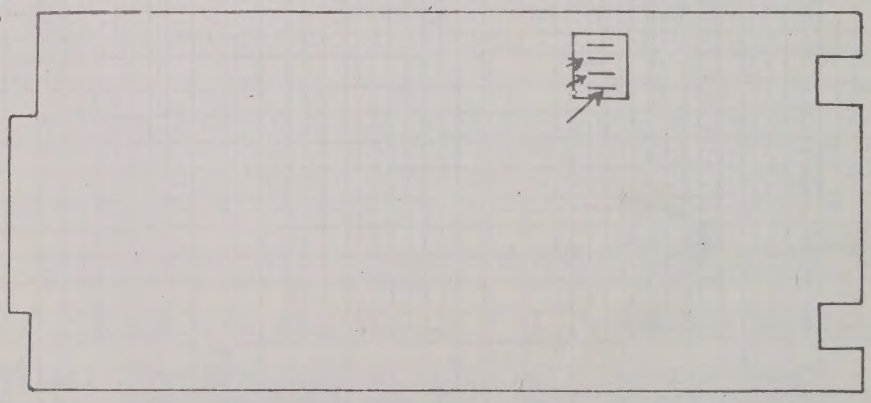
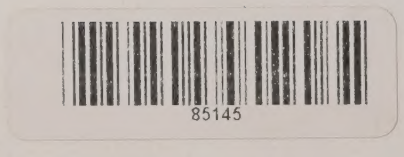


FIGURE 4.12 CPU BOARD - LOCATION OF INTERNAL SWITCHES


85145